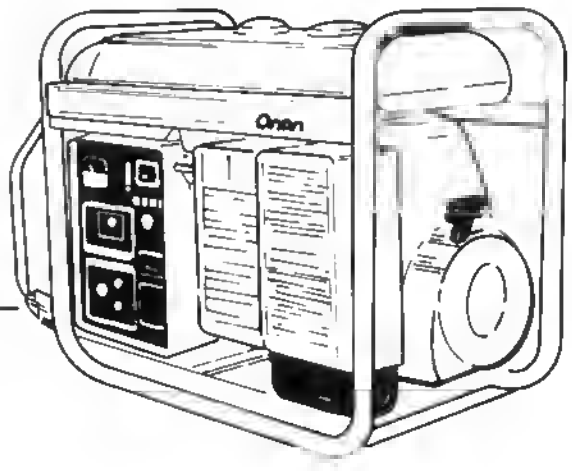
Onan

Service Manual

K5000

GenSets



- **Portable Generator**

981-0505
1-89
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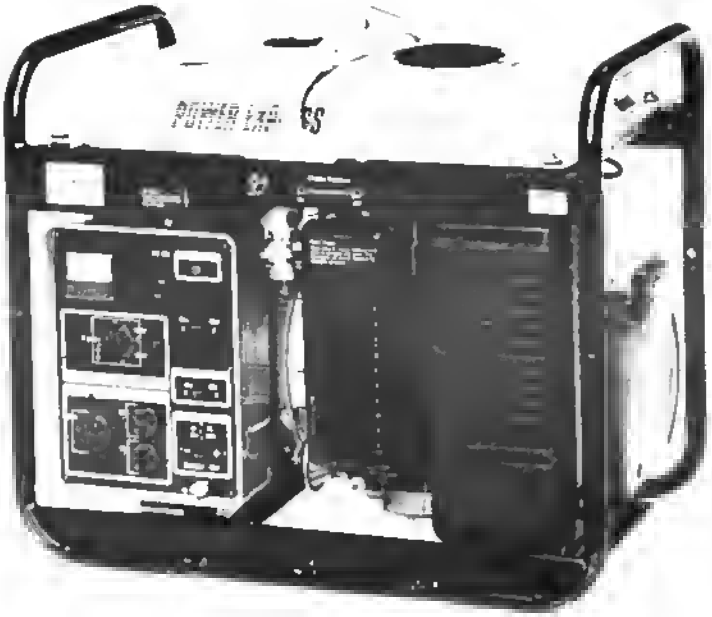
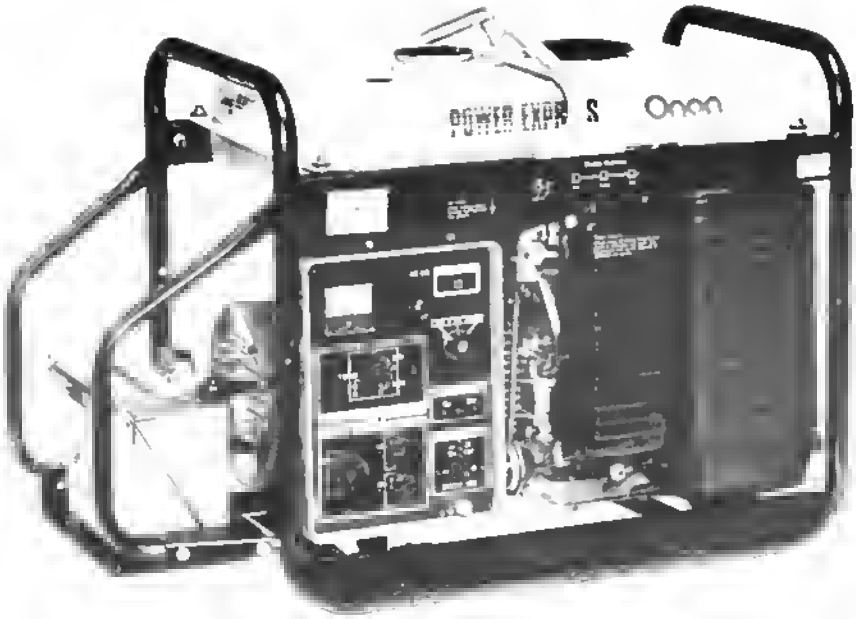
CONTENTS

GENERAL





1. SAFETY PRECAUTIONS

The following symbols in this manual signal potentially dangerous conditions to the operator or equipment. Read this manual carefully and know when these conditions can exist. Then, take necessary steps to protect personnel as well as equipment.

⚠DANGER **This symbol if used warns of immediate hazards which will result in severe personal injury or death.**

⚠WARNING **This symbol refers to a hazard of unsafe practice which can result in severe personal injury or death.**

⚠CAUTION **This symbol refers to a hazard of unsafe practice which can result in severe personal injury or product or property damage.**

Fuels, electrical equipment, batteries, exhaust gases and moving parts present potential hazards that could result in serious, personal injury. Take care in following these recommended procedures.

■ **Use Extreme Caution Near Gasoline. A constant potential explosive or fire hazard exists.**

Do not fill fuel tank with hot engine or engine running. Do not smoke or use open flame near the unit or the fuel tank.

Do not store or transport the generator set without first removing the fuel from the fuel tank.

Have a fire extinguisher nearby. Be sure extinguisher is properly maintained and be familiar with its proper use. Extinguishers rated ABC by the NFPA are appropriate for all applications. Consult the local fire department for the correct type of extinguisher for various applications.

■ **Guard Against Electric Shock**

Disconnect electric power before removing protective shields or touching electrical equipment. Use rubber insulative mats placed on dry wood platforms over floors that are metal or concrete when around electrical equipment. Do not wear damp clothing (particularly wet shoes) or allow skin surfaces to be damp when handling electrical equipment.

Jewelry is a good conductor of electricity and should be removed when working on electrical equipment.

DO NOT PLUG PORTABLE GENERATOR SET DIRECTLY INTO A HOUSE RECEPTACLE TO PROVIDE EMERGENCY POWER. It is possible for current to flow from generator into the utility line. This creates extreme hazards to anyone working on lines to restore power. Consult an electrician in regard to emergency power use.

Use extreme caution when working on electrical components. High voltages can cause severe injury or death.

Follow all state and local electrical codes. Have all electrical installations performed by a qualified licensed electrician.

■ **Do Not Smoke While Servicing Batteries**

Batteries emit a highly explosive gas that can be ignited by electrical arcing or by smoking.

■ **Exhaust Gases Are Toxic**

Engine exhaust contains CARBON MONOXIDE, a dangerous gas that is potentially lethal. Avoid carbon monoxide inhalation by operating the generator set outdoors where exhaust gases can be discharged directly into the open air.

Do not operate the generator set in any type of enclosure that could allow exhaust gases to accumulate. Direct exhaust away from areas where people are gathered and away from buildings or enclosures.

■ **Keep The Unit And Surrounding Area Clean**

Remove all oil deposits. Remove all unnecessary grease and oil from the unit. Accumulated grease and oil can cause overheating and subsequent engine damage and may present a potential fire hazard.

Do NOT store anything on the generator set such as oil cans, oily rags, chains, wooden blocks, etc. A fire could result or operation may be adversely affected. Keep clean and dry.

■ **Protect Against Moving Parts**

Avoid moving parts of the unit. Loose jackets, shirts or sleeves should not be worn because of the danger of becoming caught in moving parts.

Make sure all nuts and bolts are secure. Keep power shields and guards in position.

If adjustments must be made while the unit is running, use extreme caution around hot exhaust moving parts, etc.

Do NOT work on this equipment when mentally or physically fatigued.

1. SAFETY PRECAUTIONS

■ FIRE PREVENTION

(1) Always stop the engine before refueling.
- Do not spill fuel.
- Wipe away any spilt gasoline and make sure its residue has evaporated before restarting.
- Do not handle gasoline while smoking.
- Pay careful attention to nearby fires.

(2) Do not place inflammable items (oil, fats, plastics paper, wood, etc.) around the generator.
(3) Do not tilt or move a running generator or it may overturn.
(4) Do not operate the generator covered with a tarp or enclosed with box or other object.
(5) Do not operate the generator indoors.
(6) Keep running generators one meter or more away from buildings and other installations.
(7) Do not cover the generator with a tarp after operation unit it is cooled.

■ EXHAUST GAS

Because exhaust gas is toxic, special attention must be paid to prevent persons and animals from potential ill effects.
(1) Do not operate the generator in poorly ventilated places such as rooms, warehouses, tunnels, and holes.
(2) Do not use the generator in a poorly ventilated place such as one surrounded by buildings or other objects which can prevent proper dispersion of exhaust gas.
(3) Do not point the exhaust outlets toward persons or houses when the generator is running.

■ HANDLING ELECTRICITY

Electricity is invisible. Lack of care may result in serious accidents. Pay careful attention to the following points:
(1) Do not use the generator in the rain.
The generator and electrical loads will be harmed.
Handling the loads with wet hands is dangerous due to electric shocks.
(2) Do not connect the generator to house wiring, since wiring, loads, and generator can be damaged and leaks may occur.

■ OTHER PRECAUTIONS

(1) Thoroughly read the operating instructions and familiarize yourself with proper operating and handling procedures.
(2) Mount the machine on a level surface.
(3) Stop the engine before checking, servicing, and cleaning. Do not splash water directly on the generator when washing with water.
(4) If abnormal sounds, odors, or vibrations occur during operation, immediately stop the engine and call your Onan dealer.
(5) Do not touch hot parts, such as a muffler, during and just after operation.
Let the generator become cool before checking and servicing.
(6) Do not operate the generator with its cover removed.
Hands or feet may be injured or wire disconnections and other troubles may occur.
(7) Make sure all operators have read the operating instructions and are familiar with all operating, handling, and safety procedures.

NOTE:

A NOTE provides key information to make procedures easier or clearer.

: Apply engine oil to the area indicated.

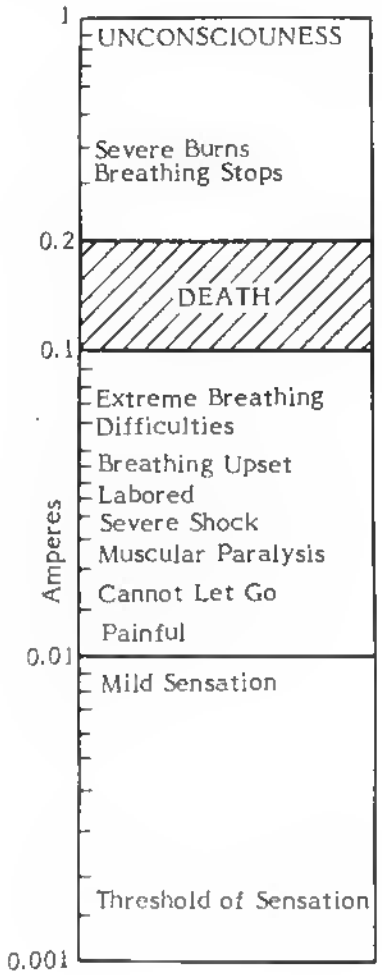
: Apply grease to the area indicated.

: Use special tools for operation.


: Tighten to the specified torque.


: Locking agent.

2. CAUTION



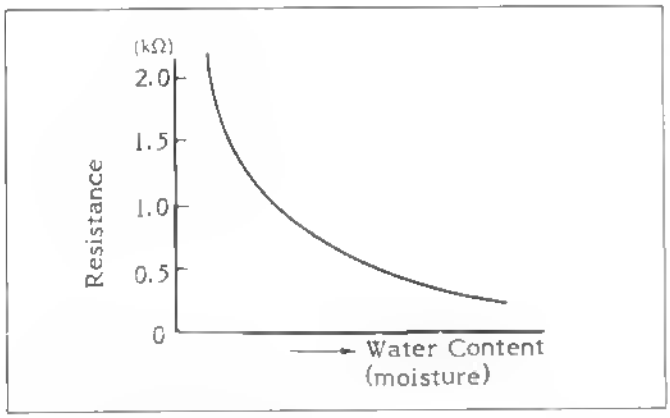


Fig. 1 Resistance of Human Skin to Moisture

Shock Hazards

Under certain conditions, any electrical device can transmit shocks and fatal currents. Many people have been electrocuted by appliances using ordinary 120 volt alternating current and by electrical apparatus using direct current as low as 42 volts.

⚠WARNING

It's the current that kills. Any current over 10 milliamperes (mA) (0.01 amp) can produce painful and severe shock, but currents between 100 and 200 mA (0.1 to 0.2 amp) are lethal killers.

Shock intensity lies in the amount of current forced through vital areas of the body. Currents above 200 mA produce severe burns and unconsciousness, but usually do not cause death, if the victim is immediately revived by artificial resuscitaton.

If a person is knocked out by an electrical shock, it is impossible to know how much current passed through his vital area. Don't waste time! Using extreme caution to avoid shock, move him to a safer place and begin resuscitation immediately.

Victims of high voltage shock usually respond to artificial respiration and their chances of survival are good if resuscitation is performed immediately.

Victims of low voltage shock do not readily respond to artificial respiration because ventricular fibrillation (uncoordinated twitching of the walls in the ventricals of the heart) prevents sudden restoration of normal pulses. A longer period of restroration may be needed. Don't give up too soon!.

What To Do For Victims of Shock

- Cut voltage and/or remove victim from contact as quickly as possible - but without endangering your own safety!
- Use a length of dry wood, rope, blanket, etc., to pry or pull the victim loose.
- Don't waste valuable time looking for the power switch. The resistance of the victim's contact decreases with time. The fatal 100 to 200 milliampere level may be reached if action is delayed.
- If the victim is unconscious and has stopped breathing, start artificial respiration at once.
- Do not stop resuscitation until medical authority pronounces the victim beyond help! It may take as long as eight hours to revive the patient. There may be no pulse and a condition similar to rigor mortise may be present; however, the visible appearance is not an indication the victim is dead.

3. ELECTRICAL TERMS

1. Hertz

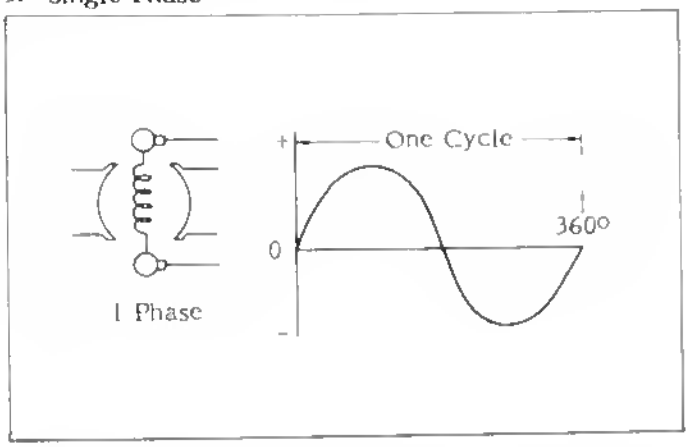
HERTZ is a unit of frequency (Hz), one cycle per second. Written as 50-hertz or 60-hertz alternating current, etc.

2. Frequency

Frequency of alternating current is the number of cycles per second. 60-hertz alternating current makes 60 complete cycles of flow back and forth (120 alternations) per second. A conventional alternator has an even number of field poles arranged in alternate north and south polarities.

$$\text{Frequency (hertz)} = \frac{\text{P (No. of poles)}}{120} \times \text{RPM}$$

3. Single Phase



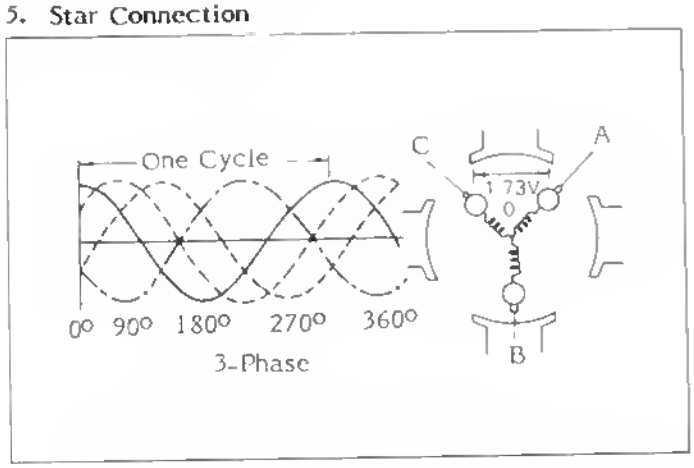
A single phase, alternating-current system has a single voltage in which voltage reversals occur at the same time and are of the same alternating polarity throughout the system.

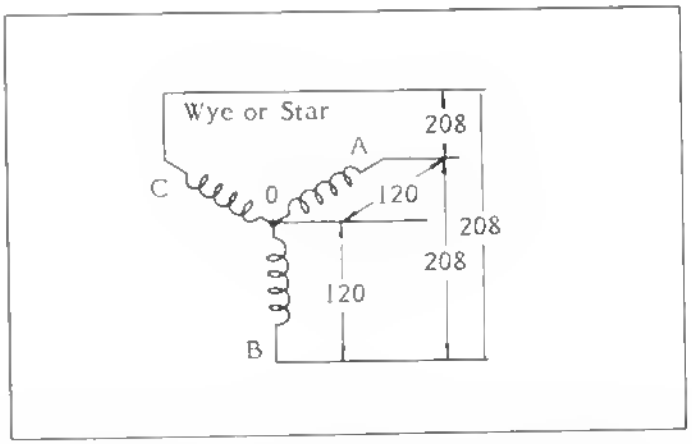
4. Three Phase

A three phase, alternating-current system has three individual circuits or phases. Each phase is timed so the current alternations of the first phase is 1/3 cycle (120°) ahead of the second and 2/3 cycle (240°) ahead of the third.

3-PHASE VOLTAGE = ONE PHASE VOLTAGE x 1.732

5. Star Connection

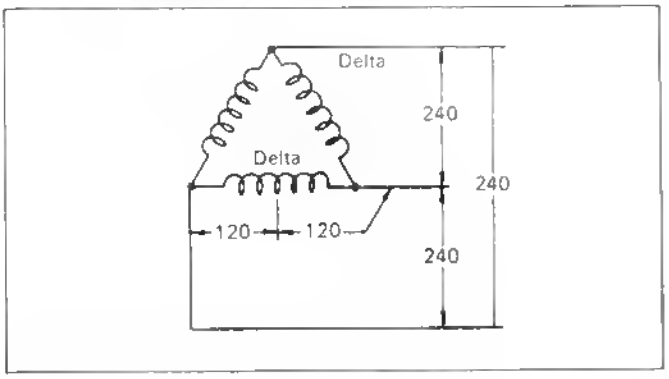




The Y (wye) or Star, connection has one end of each coil connected together as at 0.

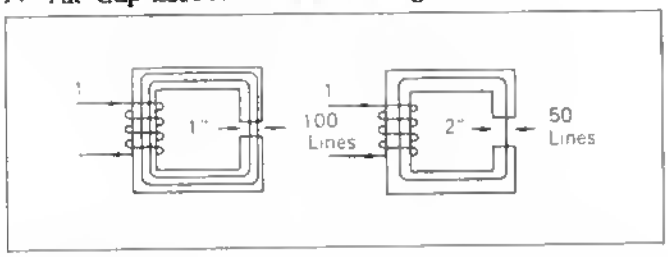
If V represents voltage generated in one conductor (or all the series conductors in one phase) it will also be equal to the voltage from the common point 0 (commonly called star or neutral point), to terminal A, C or B. The voltage between terminals A to C; C to B; or B or A, will be 1.73 x V.

6. Delta Connection



If the Delta connection is used, the conductor ends are connected as shown in the figure. In that case, the voltage in each coil is the voltage between terminals.

7. Air Gap Effect on Field Strength



The effect of an air gap on the total field strength of an electromagnet is very pronounced because air has much higher reluctance than iron. If the width of the air gap is doubled, the reluctance quadruples and field strength reduces to about half. Reluctance increases as the square of the distance.

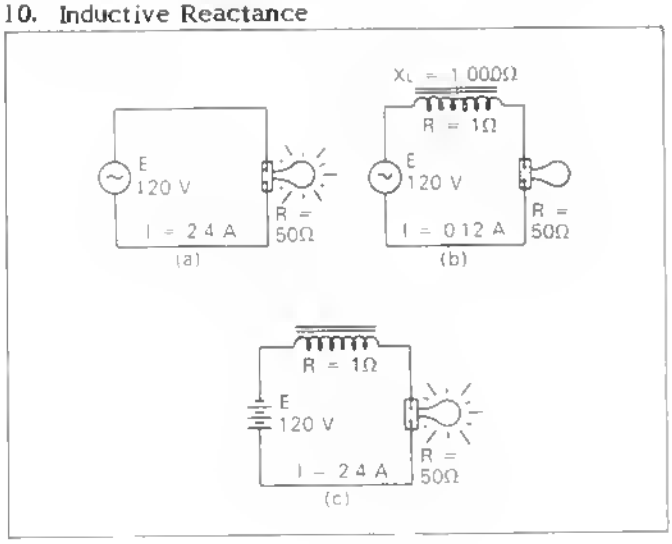
8. Inductance

Any device with iron in its structure has a magnetic inertia which opposes any change of current or change in voltage. Inductance is quite apparent with alternating current since the voltage is continually changing in instantaneous value while the magnetic inertia is causing changes in current to lag behind changes in voltage. The characteristic that causes the magnetic inertia is self inductance. Inductance like self inductance is measured in henries (H).

9. Reactance

Reactance is the opposition to the change of current or voltage in an AC circuit. The alternating current applied to the circuit will be affected by capacitance or inductance and cause the current waves to get out of step with the voltage waves.

10. Inductive Reactance



The opposition of self inductance to current flow is called inductive reactance because it causes the current to lag behind the voltage that produces it. In an AC circuit with a definite frequency, inductance results in an inductive reactance (X_L) which is measured in ohms and is determined by the formula:

$$X_L(\Omega) = 2\text{PifL or } X_L(\Omega) = 2 \times 3.1428 \times \text{Hz} \times \text{H}$$

Figure shows how the inductive reactance of a coil reduces the current to a light bulb.

- In (a) with no inductance, the AC voltage source produces 2.4 amperes to light the bulb.
- In (b) connecting a coil with 1-ohm resistance but having an inductive reactance of 1000 ohms, limits the alternating current to 0.12 amperes at the bulb, so it can not light.
- In (c) with the coil still in series with the bulb, but applying battery voltage (DC without current variations), the bulb lights as though the coil is a length of wire with 1-ohm resistance.

3. ELECTRICAL TERMS

11. Capacitive Reactance

The opposition of capacitance to the change of AC voltage causes the current wave to lead the voltage wave and is called capacitive reactance. It is measured in ohms and is determined in AC circuits by the formula:

$$Xc = \frac{1}{2PifC} \text{ or } Xc = \frac{1}{2 \times 3.1428 \times Hz \times C}$$

- Pure resistance (R) opposes current flow, but allows current to remain in phase with voltage.
- Inductive reactance (X_L) causes current to lag voltage by 90 degrees.
- Capacitive reactance (Xc) causes current to lead voltage by 90 degrees.

IMPEDANCE (MΩ) is the total opposition to current flow in an AC circuit.

$$\text{AC ohms} = \sqrt{R^2 \times (X_L - Xc)^2}$$

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12. Kilowatt

A kilowatt (kW) is a unit of measurement of electrical power equal to 1000 watts. It is the product of the volts times the amperes divided by 1000 when used in rating direct current machinery. It is also the term used to indicate true power in an AC circuit.

$$\text{Kilowatts} = \frac{A \times V \times P.F. \text{ (1-Phase)}}{1000}$$

$$\frac{A \times V \times 1.73 \times P.F. \text{ (3-Phase)}}{1000}$$

---

13. Kilowatt Hour

A kilowatt hour (kWh) is the amount of electrical power represented by 1000 watts for a period of 1 hour. Thus, a generator which delivers: 1000 watts for a period of 1-hour delivers 1-kilowatt hour of electricity.

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14. Kilovolt Amperes

Kilovolt-amperes (kVA) is the product of the volts times the amperes (measured with a voltmeter and ammeter) divided by 1000. This term is used in rating alternating current machinery because with alternating curents, the product of the volts times the amperes usually does not give the true average power. See Reactance and Power Factor.

$$\text{Kilovolt - Amperes } \frac{A \times V}{1000} \text{ (1-Phase)}$$

$$\frac{A \times V \times 1.73}{1000} \text{ (3-Phase)}$$

---

15. Power

Electrical power W or kW is measured in watts or multiples thereof; and assuming that the AC voltages and currents are in phase:

$$\text{Direct Current } W = VA \quad kW = \frac{VA}{1000}$$

$$\text{1 Phase (AC) } W = VA \quad kW = \frac{VA}{1000}$$

$$\text{3 Phase (AC) } W = 1.73\ VA, kW = \frac{1.73\ VA}{1000}$$

where V = effective line to line volts
A = effective line current

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16. Apparent Power

If the current and voltage are not in phase, that is, do not reach corresponding values at the same instant, the resultant product of current and voltage is apparent power instead of actual power. Apparent power (AV) (kVA) is measured in volt-amperes (VA) or kilovolt amperes (kVA = VA/1000).

Apparent power is measured as follows:

On single phase service–

$$\text{Volt amperes} = VA, kVA = \frac{VA}{1000}$$

On three-phase service–

$$\text{Volt amperes} = 1.73\ VA, kVA = \frac{1.73\ VA}{1000}$$

Actual power (kW) is the product of kVA and the power factor expressed as a decimal).

Thus – kW = kVA·PF

17. Power Factor

The power factor (PF) of a generator is the percentage by which apparent watts (AW) must be multiplied to give true watts (TW). The PF depends on the amount that the current lags behind the applied voltage due to inductive reactance (induced current which opposes the applied current in the coils of the generator and load). If a generator is rated in kVA at 80% PF, it will generate its rated voltage and carry an 80% PF load as long as the load does not exceed the kVA rating.

With a PF of 80% (0.8) a fully loaded 5 kVA - 0.8 PF alternator will deliver 4000 true watts or 4 kW if divided by 1000.

The power factor must be considered in all motor starting applications. The PF determines the starting kW requirement. Motor starting amperes or kVA is usually stamped on the motor nameplate.

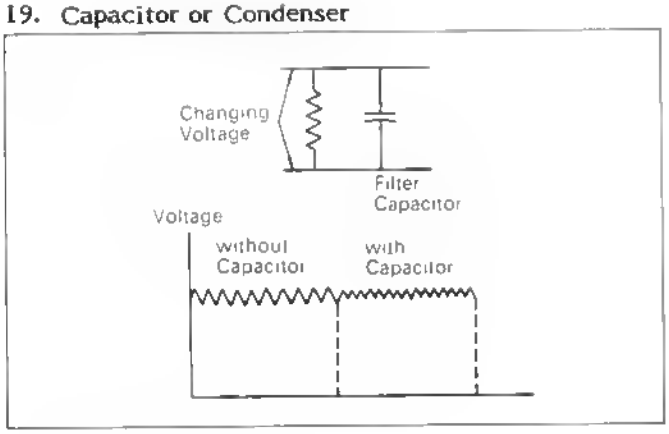
18. Capacitance

The capacity to take an electric charge is known as capacitance and is measured in farads (F).

If voltage is applied to two conductors separated by an insulator, the insulator takes an electrical charge. When AC voltage is applied, alternating current flows into and out of the insulator (called a dielectric) and charges and discharges it with each reversal of alternating current. The charge reaches maximum, but the current becomes zero as the voltage reaches maximum.

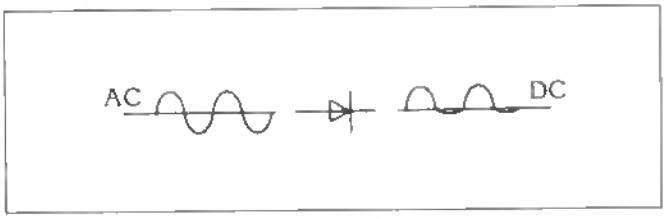
Capacitance is opposite to inducance in that the current changes precede (lead) the voltage changes.

19. Capacitor or Condenser



A capacitor stores electrical changes, conducts AC and blocks DC. It is an electrical device which causes the current to lead the voltage, opposite in effect to inductive reactance. Capacitors are used to neutralize the objectional effect of lagging current (inductive reactance) which overloads the power source, Figure (Capacitor Usage). It also acts as a low resistance path to ground for currents of radio frequency, thus effective reducing radio disturbance.

20. Rectifier



A device, solid-state (diode) or vacuum tube, which converts AC to DC, Figure (Diode Usage). The word is also used loosely in place of "battery charger."

21. Resistance Revision

The resistance measured outside 20°C can be converted into that at 20°C with the following formula:

$$R = ((234.5 + 20)/(234.5 + t_1)) \times R_1$$

where t is the temperature when the resistance is measured and R_1 is the resistance measured at t_1.

$t_1 = 30 \quad R_1 = 10$

$(234.5 + 20)/(234.5 + 30) \times 10 = 9.62\Omega$

* The resistance should be 9.62Ω at a temperature of 20°C.

4. ELECTRICAL FORMULAS

(NEW SYMBOLS)

FACTOR	ALTERNATING CURRENT	DIRECT CURRENT
Watts	A x V x PF (1-phase) A x V x 1.73 x PF (3-phase)	A x V
Kilowatts	$\frac{A \times V \times PF}{1000}$ (1-phase)	$\frac{A \times V}{1000}$
	$\frac{A \times V \times 1.73 \times PF}{1000}$ (3-phase)	
Amperes (when kW is known)	$\frac{kW \times 1000}{V \times PF}$ (1-phase)	kW x 1000
	$\frac{kW \times 1000}{V \times 1.73 \times PF}$ (3-phase)	
Kilovolt-amperes (kVA)	$\frac{A \times V}{1000}$ (1-phase)	
	$\frac{A \times V \times 1.73}{1000}$ (3-phase)	
Frequency (hertz) Hz	$\frac{P \times r.p.m.}{120}$	
Revolutions per minute	$\frac{Hz \times 120}{P}$	
Number of poles	$\frac{Hz \times 120}{r.p.m.}$	
Amperes when kilovolt-amperes is known	$\frac{kVA \times 1000}{V}$ (1-phase)	
Amperes when horsepower is known	$\frac{kW}{V \times PF \times \%Eff}$	$\frac{kW}{V \times \%Eff}$
Voltage tolerance	$\% = \frac{\text{No load - Full load voltage}}{2 \times \text{rated voltage}} \times 100$	
Voltage regulation	$\% = \frac{\text{No load - Full load voltage}}{\text{Full load volts}} \times 100$	
Voltage drop	V = A x R or V = A x Z	V = A x Ω
Speed regulation	$\% = \frac{\text{No load - Full load}}{\text{Full load speed (r.p.m.)}} \times 100$	

GENERATOR

1. SPECIFICATIONS

1-1. SPECIFICATIONS

Item \ Model	Unit	K5000(B)
DIMENSIONS (Without Hanger)		
Overall length	mm, in	664 (842), 26.14 (33.15)
Overall width	mm, in	431, 16.97
Overall height	mm, in	565, 22.24
Weight	kg, lb	86, 189.60
ENGINE		GS410(B)-DG-ONAN
Type		4-stroke
Number of cylinders		I
Total piston displacement	cm^3, in^3	412, 25.1
Rated output	PS/RPM	60Hz: 8.0/3,600
Fuel consumption (with a full tank)	hr.	60Hz:5.0
Fuel		Gasoline
Fuel tank capacity	Lit., US gal	18.5, 4.9
Lubrication oil capacity	cm^3, US qt	1,200, 1.27
Ignition system		C.D.I.
Cooling system		Forced air
Spark plug		BPR6HS (NGK)

GENERATOR (A.C. output)

Item \ Model	Unit	K5000(B)	
Rated voltage	V	120	240
Frequency	Hz	60	60
Rated output	kW	4.3	4.3
Rated current	A	35.8	17.9

GENERATOR (D.C. output)
Rated voltage: 12V
Rated current: 10A

Standard equipment

Circuit breaker for AC
Protector for DC
Voltage meter
Fuel gauge
Receptacle for AC
NEMA 5-20R, parallel slot — 20 amp. 125 volt.
NEMA LA-30R — 30 amp. 125 volt.
NEMA L14-20R — 20 amp. 125/245 volt. (Dual Voltage)
Receptacle for DC
JEC-7 — 15 amp. 12 volt.
Automatic idler
Oil watch

NOTE: The DC output should be used for charging the battery.

1. SPECIFICATIONS

1-2. SERVICING DATA

1-2-1 TIGHTENING TORQUES

Item	Size x Pitch	Tightening Torque		
		N·m	kgf·m	ft-lbs
Front bracket mounting bolt		17.7 to 21.6	1.8 to 2.2	13.0 to 16.0
Rotor center bolt		4.0 to 5.0	4.0 to 4.5	29.0 to 36.0
Stator through bolt		5.9 to 8.8	0.6 to 0.9	4.3 to 6.5

1-2-2 SERVICING SPECIFICATIONS

GENERATOR

Type		K5000(B)
Generator Ass'y Parts No.		*
Stator Ass'y Parts No.		*
Stator Coil Resistance (at 20°C)	Main Coil (M.C) (at 20°C)	0.25 Ω (R-L) (W-B)
	DC Coil (DC.C) (at 20°C)	0.044 Ω (WY-WY)
	SUB Coil (SB.C) (at 20°C)	0.27 Ω (WBr-WY)
Rotor Coil Ass'y Parts No.		*
Rotor Coil Resistance (at 20°C)	Field Coil	6.0 Ω
	Exciter Armature Coil	1.1 Ω
Exciter Field Coil (at 20°C)	Exciter Field 1	4.5 Ω (Vi-Gr)
	Exciter Field 2, 3	0.033 Ω (WOr-WB, BrW-Y)
Rotor Air Gap, Exciter Air Gap		0.4 mm 0.016 in.
Diode Stack (4 pieces)		400V - 25A (Re1), 400V - 15A (Re2, Re3)
Bearing Type		#62055ZZ
Bearing Grease		Shell Albania No. 2
Control Ass'y Parts No.		*

*: Refer to parts book.

1. SPECIFICATIONS

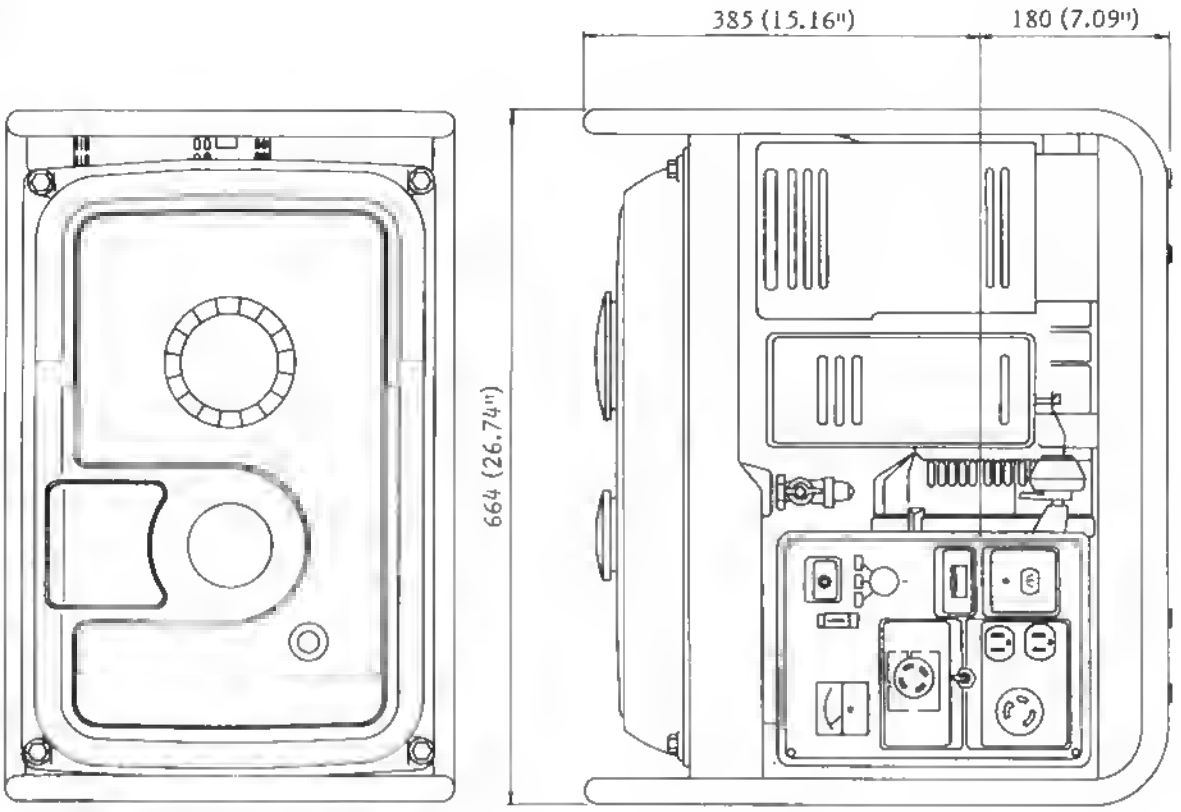
CONTROL PANEL

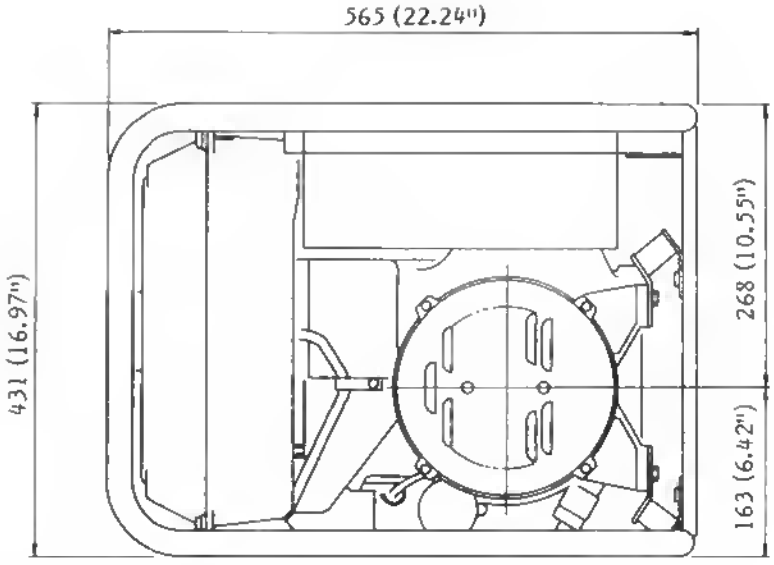
Type	K5000(B)
Key Switch No. (ENGINE SWITCH)	54821-41210 , BLAII 250V-6A
AC Output Receptacle 1	NEMA L14-20R , AC 125/250V - 20A
AC Output Receptacle 2	NEMA L5-30R , AC 125V - 30A
AC Output Receptacle 3	NEMA L5-15R , AC 125V - 15A
DC Output Receptacle	250V - 15A
No Fuse Breaker (AC)	250V - 20A
Thermal Protector Capacity (DC)	250V - 15A
Toggle Switch	A4TNII 250V - 20A
Voltmeter	0 to 300V
Oil Warning Lamp	DC 9V
Idle Switch	BLAII 250V - 6A
GROUND Terminal	TK-025 40A

REVOLUTION SET ADJUSTMENT STANDARD

Frequency	60Hz
Max. During No-load Run	63 ± 1.5Hz (3690 to 3870 r.p.m.)
During Idling	2200 ± 50 r.p.m.

2. GENERAL VIEW



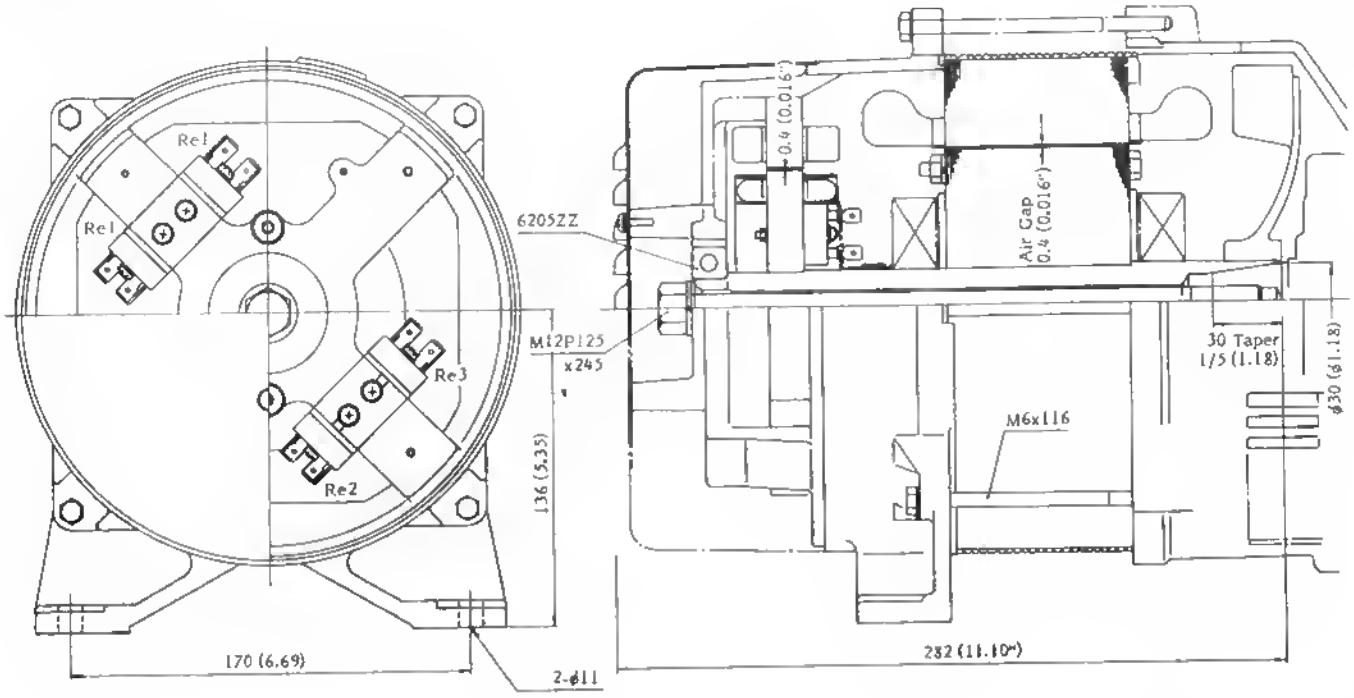


unit: mm (in.)

3. DIMENSIONS AND COMPONENTS

GENERATOR

Unit: mm (in.)



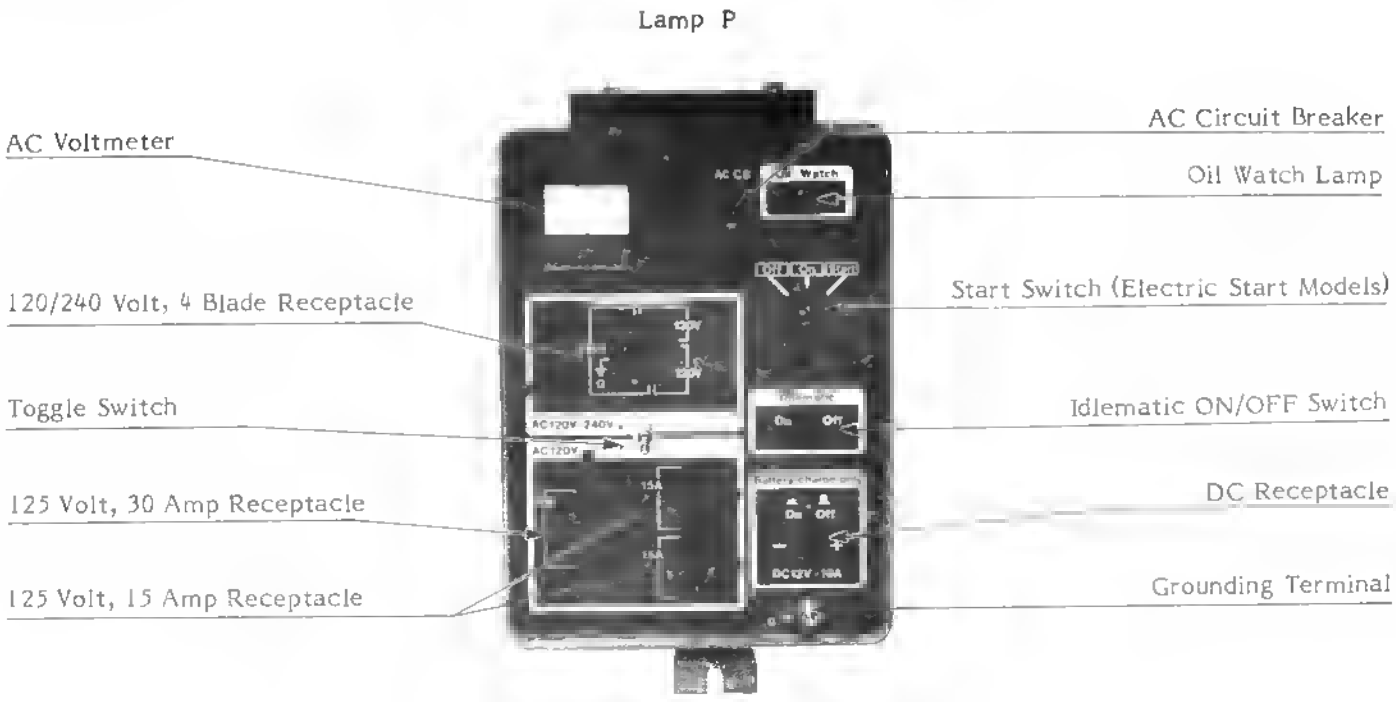
Diode stack

Re1 (for main coil)

Re2 (for sub coil)

Re3 (for DC coil)

CONTROL BOX



4. FEATURES

4-1 BRUSHLESS CURRENT FEEDBACK SYSTEM GENERATOR

Load Compensator (CFS) for K5000(B)

4-1-1 Configuration

This report explains the operation of the current feedback system (CFS), a load compensator incorporated in the K5000(B). The CFS circuit used in the K5000(B) contains two main coils, each designed to monitor the output levels in 120 V or 240 V operation. The following sections describe the operation of a single-coil system, which is a simpler version of the CFS. Figure 1 shows the load compensator circuit that stabilizes the K5000(B) output voltage.

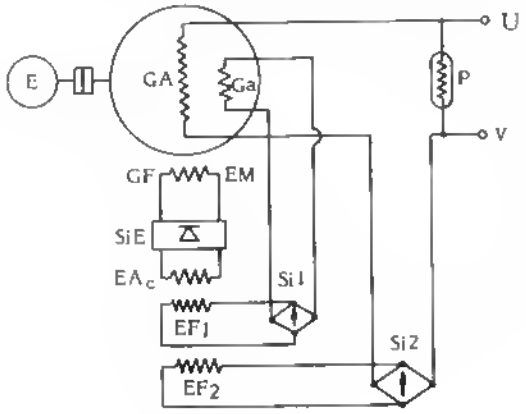


Fig. 1

Legend
GA: Generator output coil (main coil)
Ga: Auxiliary exciter coil (sub-coil)
GF: Generator field coil (FC)
EA_C: Exciter main coil
EF_1: Exciter field coil
EF_2: Exciter field coil
Si_1, Si_2, Si_E: Rectifiers
P: Positive thermistor
E: Engine
U, V: Generator output terminals

4-1-2 Operation

When the engine attains approximately 80% of the rated speed of rotation, the generator's residual voltage characteristic causes the main coil GA to generate residual voltage that is equal to a few percent of the rated output level. This residual voltage allows the current to flow through positive thermistor P, which has low resistance because of its low temperature at this stage, to the exciter field coil EF_2, creating a short circuit that energizes the exciter field coil. The magnetic field set up by the field coil EF_2 causes the main coil GA to sharply boost its output voltage to close to the rated level, and allows more current to flow through the short circuit formed by the thermistor P and exciter field coil EF_2.

The engine builds up speed to the rated level within several seconds when the current flows through the short circuit. During this period, the auxiliary exciter coil Ga voltage rises high enough to pass current via the rectifier Si_1 to the exciter field coil EF_1. The temperature of thermistor P rises, and it soon provides resistance high enough to block the current flow in the short circuit and thus gradually reduce the current flowing through the main coil GA to zero. As a result, the current flowing through the field coil EF_2 drops to approximately 0 after a time lag due to the difference between the GA and EF_2 reactance.

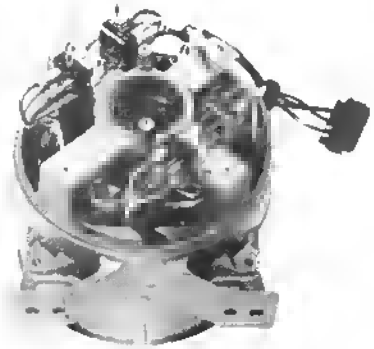
The generator output voltage, therefore, is maintained at a definite level by the voltage generated by the coil Ga and the current energizing the exciter field coil EF_1. If the generator output terminals (U and V) are connected to an external load, the circuit outputs current which is always rectified by the rectifier Si_2 and energizes the exciter field coil EF_2. Thus, the generator output voltage can be maintained by fixing the number of coil turns so that the current energizing the field coil stays at a definite level.

The reasons why the positive thermistor P is included in the circuit are that it helps facilitate generator startup, even though the generator residual voltage is low, and it takes advantage of the stable magnetic characteristics of the generator's iron core.

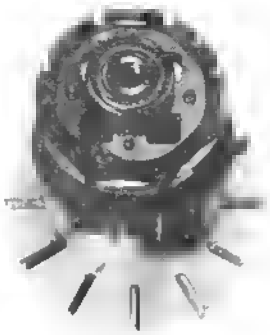
4-1-3 Features

The CFS circuit surpasses the AVR one with respect to the following points:

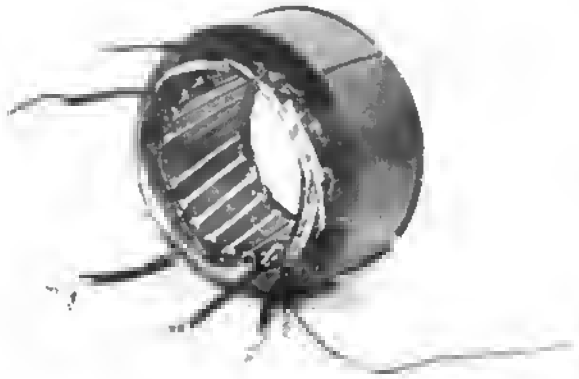
(1) The circuit contains fewer components and rarely breaks down.
(2) The generator does not burn up even at low engine speeds.
(3) The circuit provides smoother motor startup.
(4) The generator operates at the appropriate speed since the relationship between the output voltage and the rotational speed is almost linear.



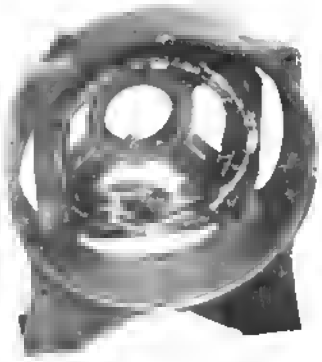
Diode stack



Exciter main coil and field coil

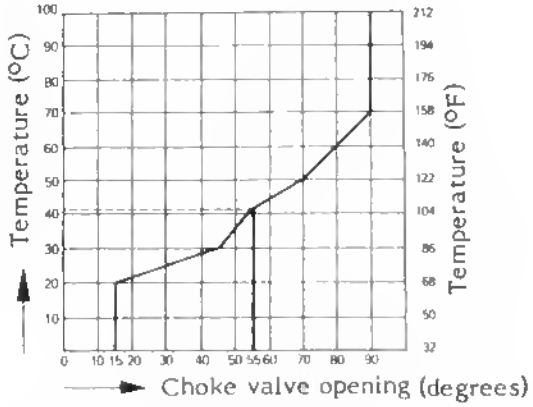


Main coil and sub coil

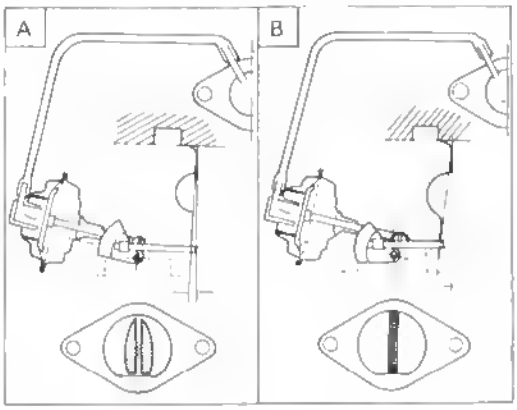


Exciter field coil

Thermal character of the bimetal spring



The choke valve fully closes at 20°C (68°F) or less and fully opens at 70°C (158°F) or more. Even though the choke valve fully closes, it has an opening of 15 degrees.

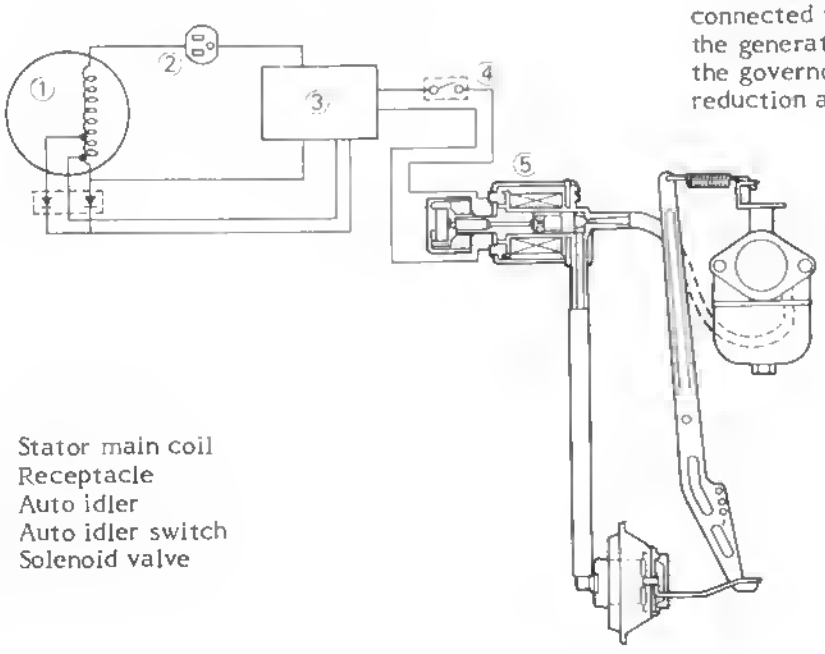


Before starting the engine
The choke valve opening depends solely on the temperature of the bimetal spring.

During operation
1) When the temperature is 41°C (106°F) or below (A). The choke valve opening is varied up to 55° by the diaphragm.
2) When the temperature is higher than 41°C (106°F) (B). The choke valve opening is varied by the bimetal spring.

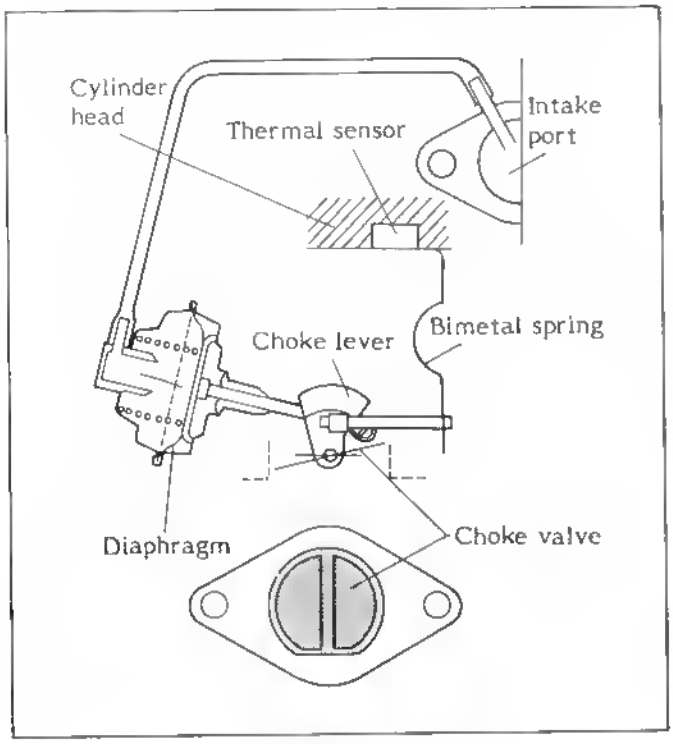
4-2. AUTO IDLER SYSTEM

The auto idler unit controls the engine speed so that the generator runs at rated speed when it is connected to a load and at half the rated speed when connected to no load. It detects the load current of the generator, and operates the diaphragm to move the governor arm. The unit also contributes to noise reduction and fuel economy.



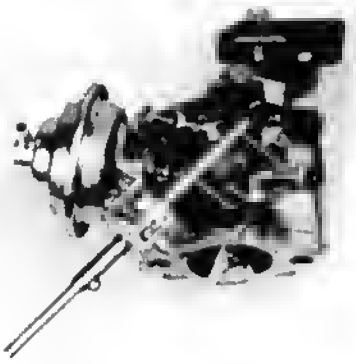
(1) Stator main coil
(2) Receptacle
(3) Auto idler
(4) Auto idler switch
(5) Solenoid valve

4-3. AUTOMATIC-CHOKE SYSTEM (ONLY "B" MODEL)

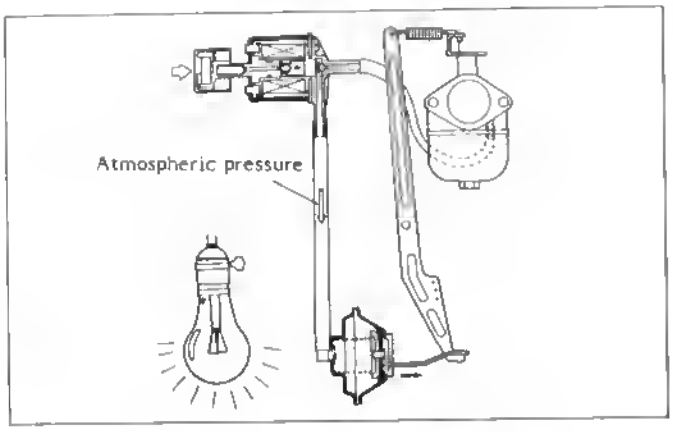


The automatic-choke system sets the operator free from troublesome operation of the choke lever when starting the engine, and it has also made it possible to start the engine through the remote control box. The choke valve can also be operated manually.

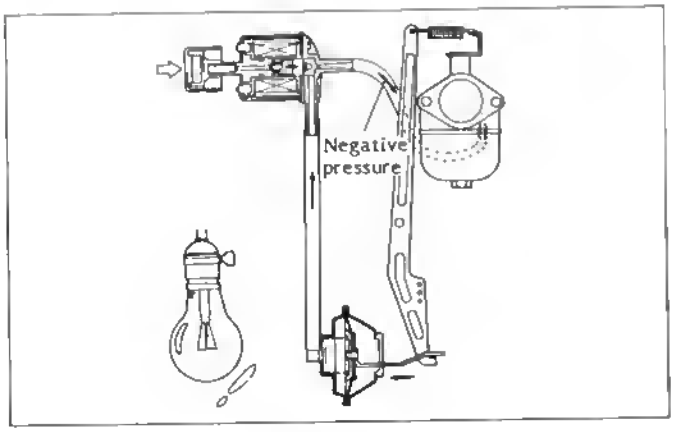
Construction and operation
The choke valve opening changes depending on the characteristics of the bimetal spring and diaphragm.



Notes:
* Speed setting under no load: About 2,000 rpm
* When the load is less than 0.8A, the auto idler unit will not detect the load current and therefore, the solenoid valve operates. Thus the engine speed will not rise to the rated speed.
* If you start the engine with the auto idler unit operated at low temperatures 0°C (32°F) or below, warm-up operation will take more time.
* When charging a 12-V battery, the auto idler unit will not operate. Turn off the switch when battery charging.



Under Load (the load is more than 0.8A)
The governor becomes free, and the engine runs at rated speed.



Under no load (the load is less than 0.8A)
The governor is pulled by the rod of the diaphragm, and the engine runs at idling speed (2,000 rpm).

5. MAINTENANCE

PERIODIC INSPECTION

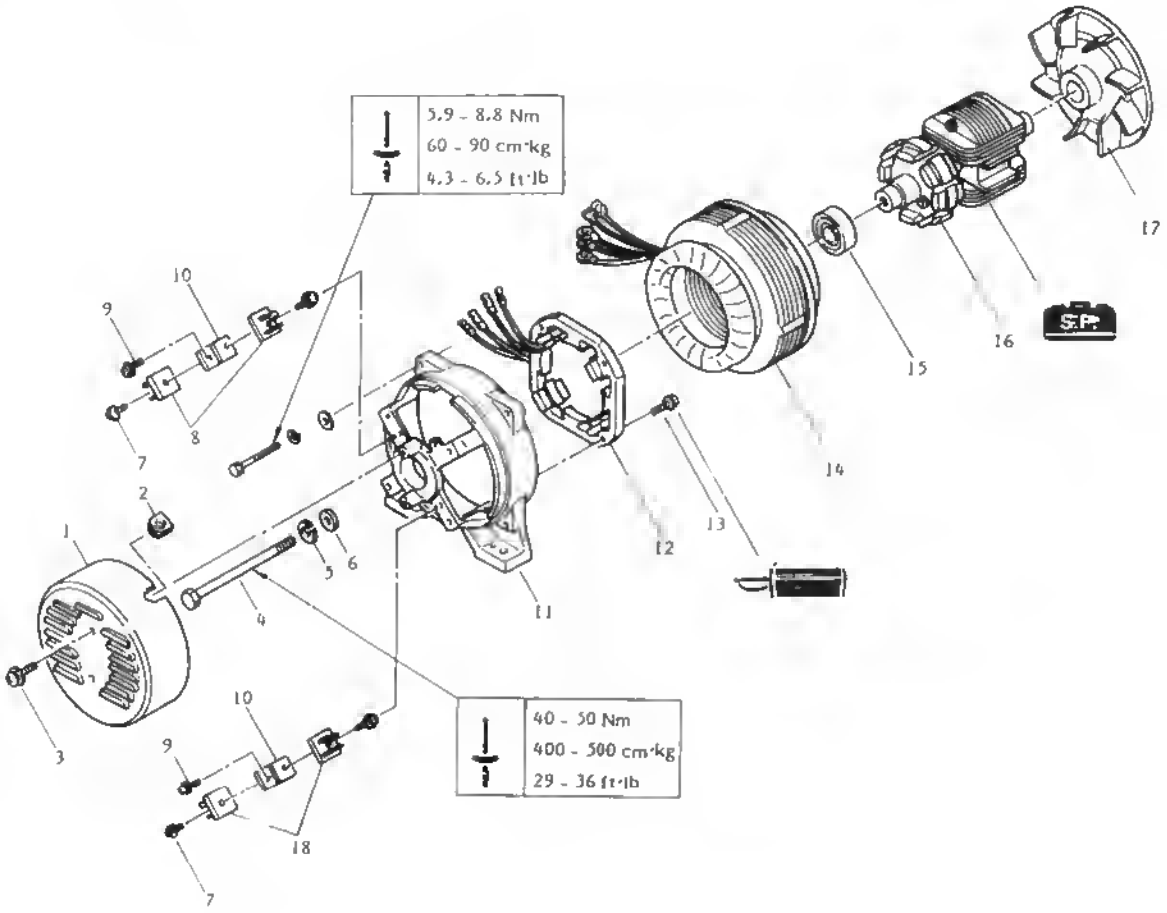
	Check item	Pre-operation check	First check (After first 20 hours)	3-month check (After first 150 hours)	Every 150 hours	Remarks
Control system	Check control lever (fuel cock, check lever) operation	o	o	o	o	
	Check recoil starter operation	o	o	o	o	
Engine	Check starting of engine and abnormal noise.	o	o	o	o	
	Check exhaust system and exhaust color.	o	o	o	o	
	Clean air cleaner element.			*o	*o	
	Check tightness of screws, bolts and nuts.			o	o	
	Engine oil change.		o	o	o	
Fuel system	Check fuel level.	o				
	Check for fuel leakage.	o	o	o	o	
	Clean fuel cock.		o	o	o	
	Clean fuel tank filter.	o	o	o	o	
	Check fuel pipes for breakage.			o	o	Replace fuel hose every 4 years.
Electrical system	Check and clean spark plug electrodes.			o	o	Plug gap: 0.6 - 0.7 mm
Battery	Check battery fluid level.	o				For "electric-start" model
	Check specific gravity			o		
Generator	Check DC receptacle and AC receptacles for damage.	o	o	o	o	
	Check lamp, voltmeter DC protector, and NFB.	o	o	o	o	

* When used in dusty area, the air cleaner element should be serviced more frequently.

* The contact edges of the air filter element should be coated with grease.

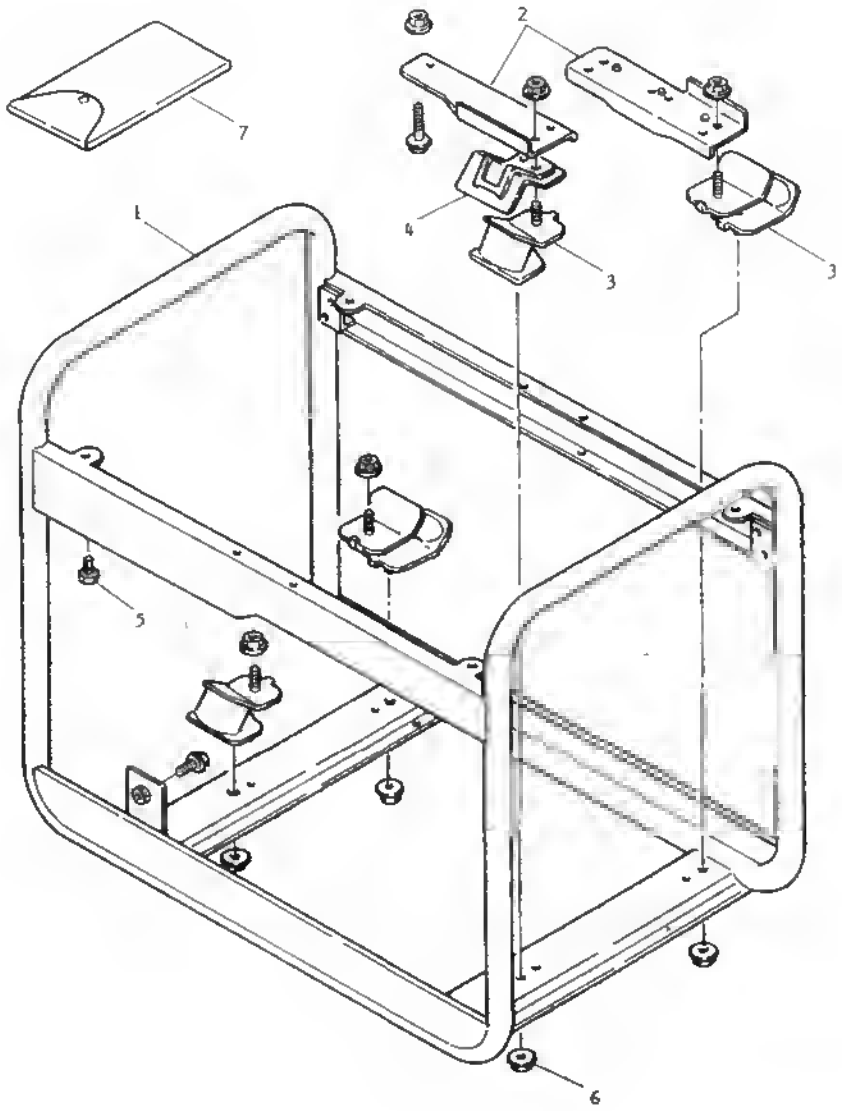
6. GENERAL COMPONENTS

6-1 GENERATOR ASS'Y



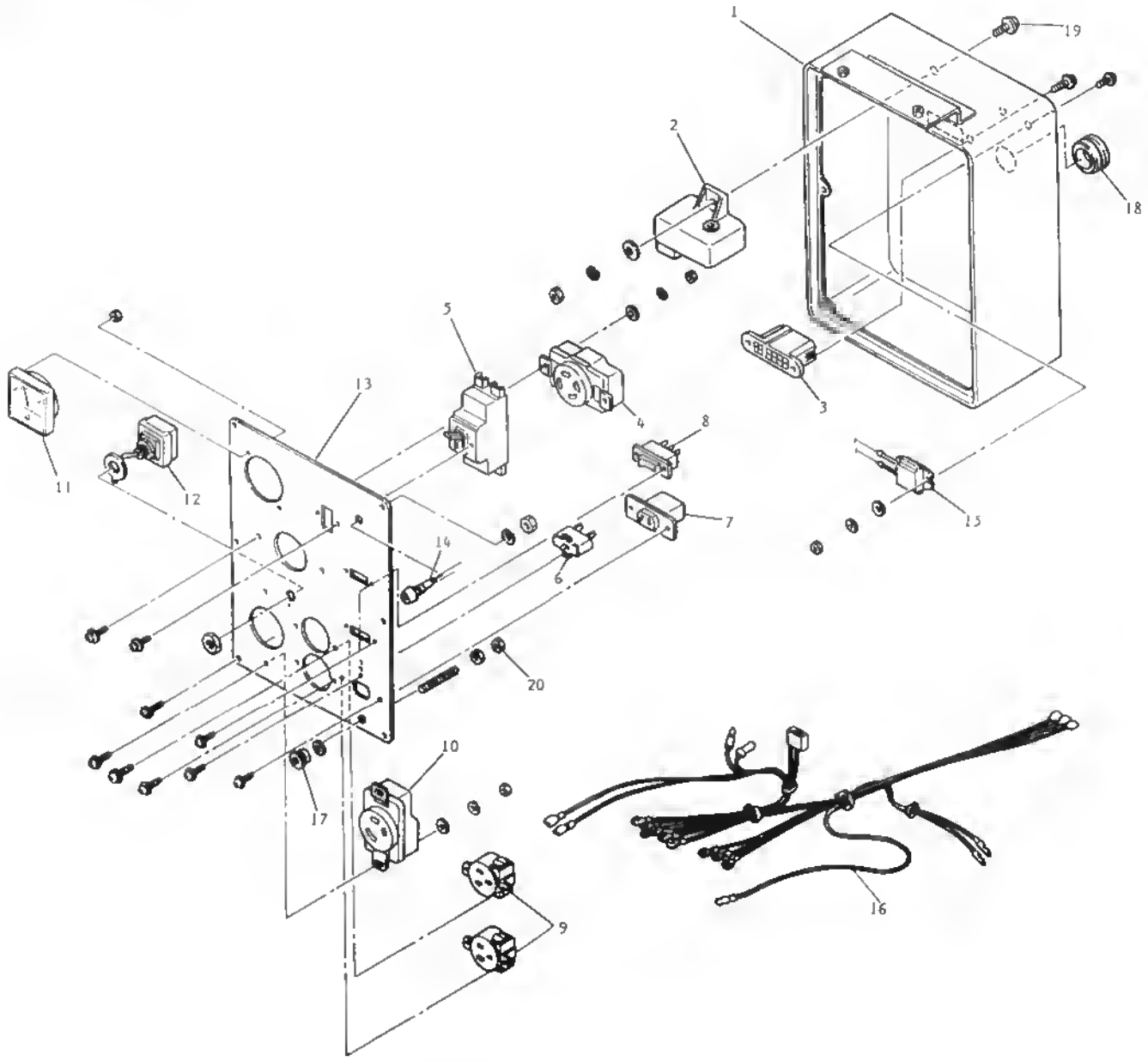
1. End cover
2. Rubber ring
3. Screw
4. Bolt
5. Spring washer
6. Plain washer
7. Screw
8. Diode for main (S25VB40)
9. Screw
10. Bracket
11. End bell
12. Exciter stator
13. Screw
14. Stator ass'y
15. Bearing (6205ZZ)
16. Rotor
17. Fan
18. Diode for DC, SB (S15VB40)

6-2 FRAME



1. Frame
2. Bracket
3. Insulator
4. Protector
5. Bolt
6. Nut
7. Tool Bag

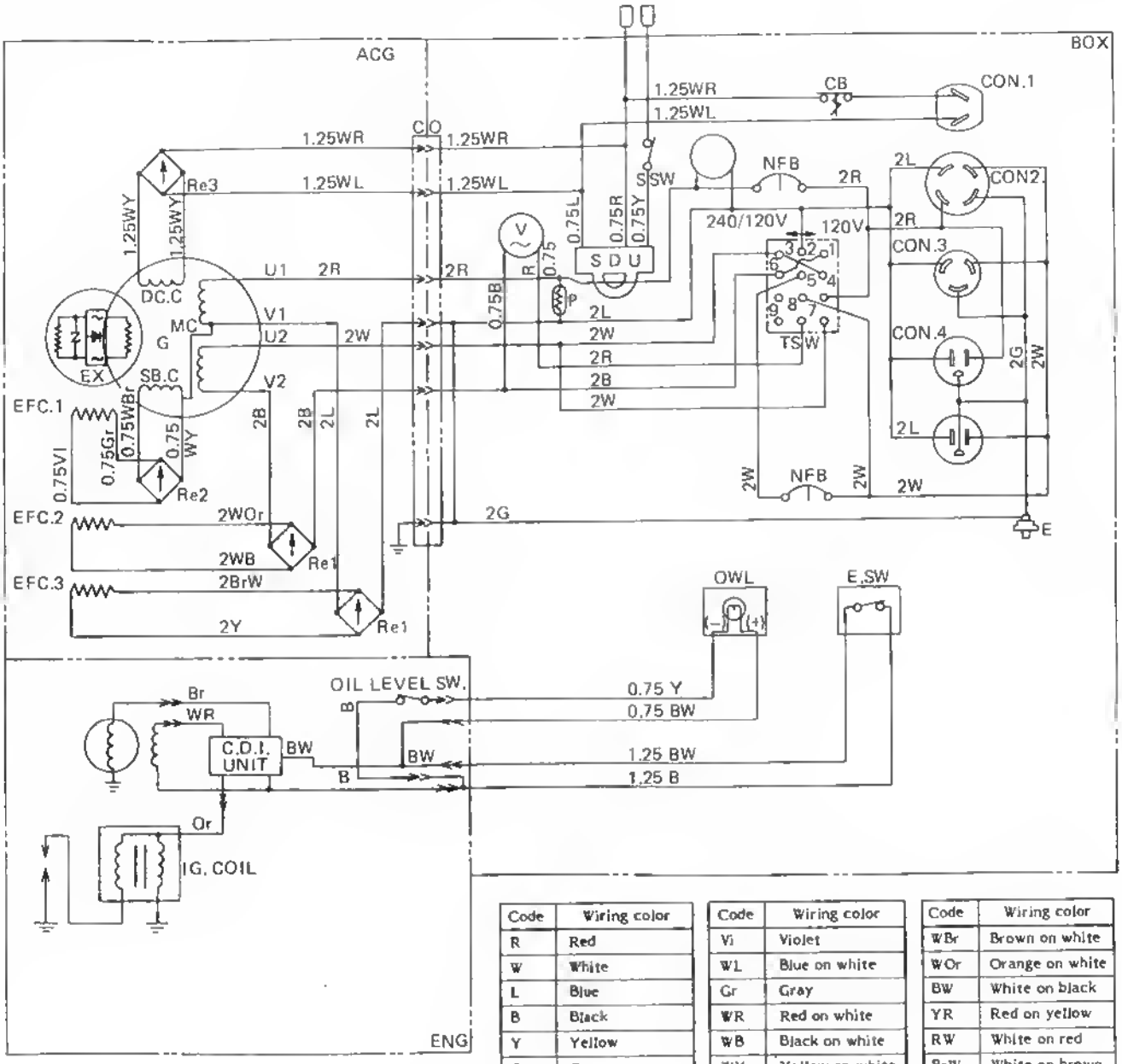
6-3 CONTROL BOX



1. Box
2. Slow down unit
3. Terminal board
4. Receptacle
5. Circuit breaker (For AC)
6. Circuit breaker (For DC)
7. Receptacle
8. Auto idler switch
9. Receptacle
10. Receptacle
11. Voltmeter
12. Toggle switch
13. Plate
14. Oil warning lamp
15. Posistor
16. Wiring harness
17. Ground terminal
18. Grommet
19. Screw
20. Nut

7. CIRCUIT CONFIGURATION DIAGRAM

CIRCUIT DIAGRAM FOR HAND STARTER MODEL



Code	Wiring color
R	Red
W	White
L	Blue
B	Black
Y	Yellow
G	Green

Code	Wiring color
Vi	Violet
WL	Blue on white
Gr	Gray
WR	Red on white
WB	Black on white
WY	Yellow on white

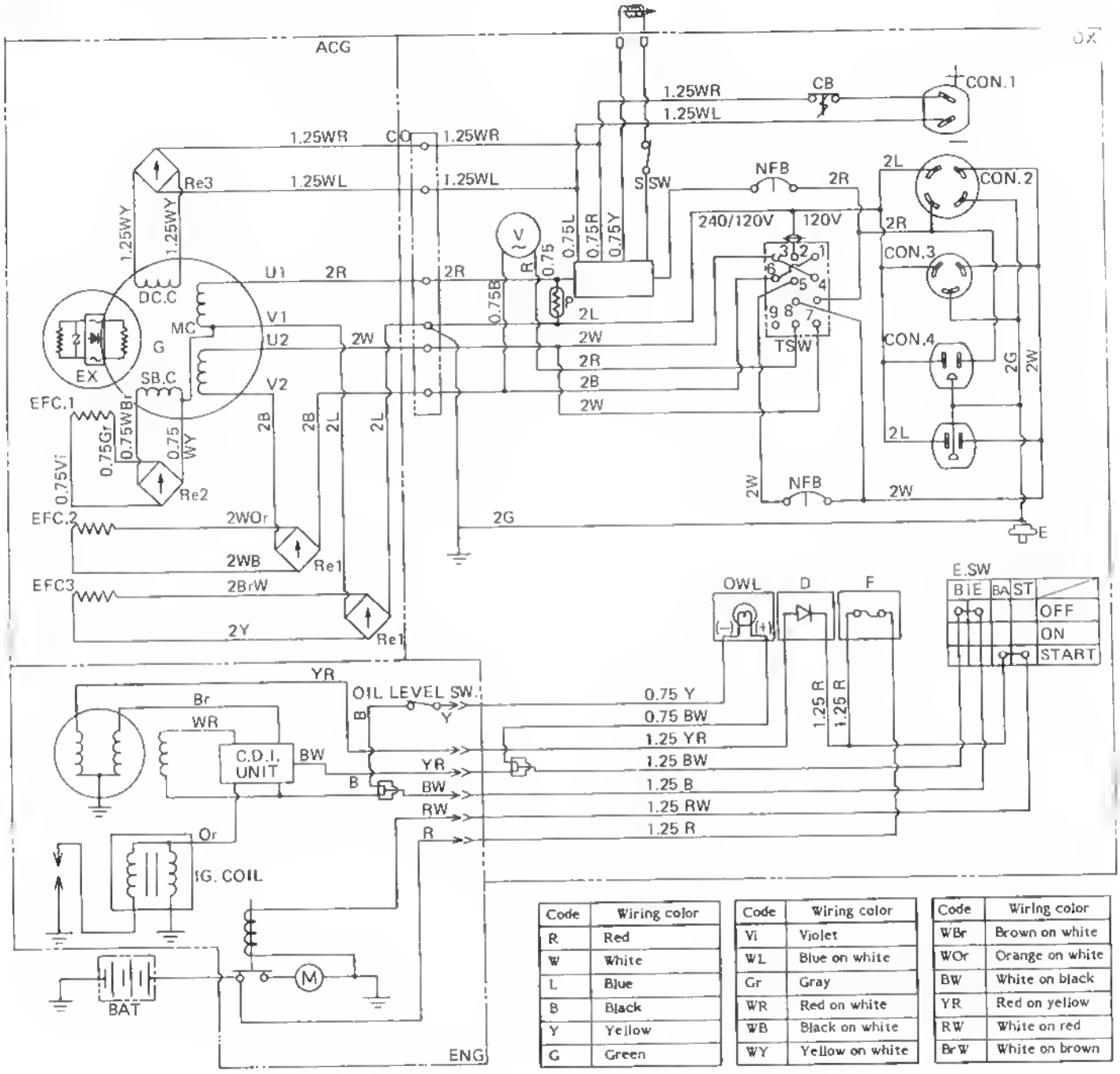
Code	Wiring color
WBr	Brown on white
WOr	Orange on white
BW	White on black
YR	Red on yellow
RW	White on red
BrW	White on brown

Code	Name	Remarks
P	POSISTOR	PTH462 124AR 4R7N180
BAT	BATTERY	
Re3	SILICON DIODE	S15VB40
Re2	SILICON DIODE	S15VB40
Re1	SILICON DIODE	S25VB40
CO	CONNECTOR	
OWL	OIL WARNING LAMP	D8-99 DC6V
E.SW	ENGINE SWITCH	BLA1.1
SSW	SLOWDOWN SWITCH	BLA1.1
TSW	TOGGLE SWITCH	A4TN1.1

Code	Name	Remarks
SDU	SLOW DOWN UNIT	TC-03
V	VOLTAGE METER	TRR-50 0 - 300 V
NFB	NO FUSE BREAKER	JB-32Q AC240V 20A
CB	CIRCUIT BREAKER	TBC5231-01-1410 250V 15A
CON4	RECEPTACLE	NEMA5-15R AC125V 15A x 2
CON3	RECEPTACLE	NEMA L5-30R AC12V 30A
CON2	RECEPTACLE	NEMA L14-20R AC125/250V 20A
CON1	RECEPTACLE	JEC-7
E	EARTH TERMINAL	TK-025 40A

7. CIRCUIT CONFIGURATION DIAGRAM

CIRCUIT DIAGRAM FOR ELECTRICAL STARTER



Code	Wiring color
R	Red
W	White
L	Blue
B	Black
Y	Yellow
G	Green

Code	Wiring color
Vi	Violet
WL	Blue on white
Gr	Gray
WR	Red on white
WB	Black on white
WY	Yellow on white

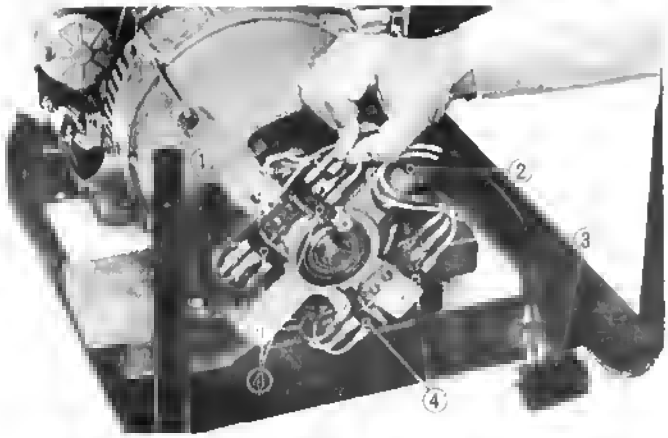
Code	Wiring color
WBr	Brown on white
WOr	Orange on white
BW	White on black
YR	Red on yellow
RW	White on red
BrW	White on brown

Code	Name	Remarks
P	POSISTOR	PTH462 124AR 4R7N180
BAT	BATTERY	
Re3	SILICON DIODE	S15VB40
Re2	SILICON DIODE	S15VB40
Re1	SILICON DIODE	S25VB40
CO	CONNECTOR	
OWL	OIL WARNING LAMP	DB-99 DC6V
E.SW	ENGINE SWITCH	54821-41211
SSW	SLOWDOWN SWITCH	BLA1.1
TSW	TOGGLE SWITCH	A9TN1.1
F	FUSE	U0963 10A

Code	Name	Remarks
SDU	SLOW DOWN UNIT	TC-03
V	VOLTAGE METER	TRR-50 0 - 300 V
NFB	NO FUSE BREAKER	JB-32Q AC240V 20A
CB	CIRCUIT BREAKER	TBC5231-01-1410 250V 15A
CON4	RECEPTACLE	NEMA5-15R AC125V 15A x 2
CON3	RECEPTACLE	NEMA L5-30R AC125V 30A
CON2	RECEPTACLE	NEMA L14-20R AC125/250V 20A
CON1	RECEPTACLE	JEC-7
E	EARTH TERMINAL	TK-025 40A
D	DIODE	SGC-1502S

End Cover
1. Remove the end cover.

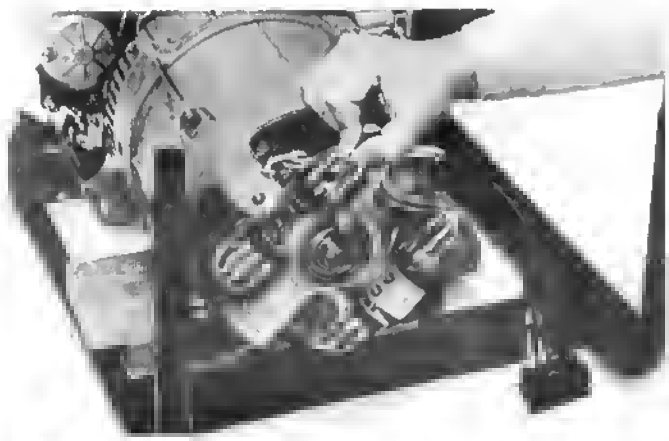
(When reassembling)
- Assemble the end cover, with the window facing downward.

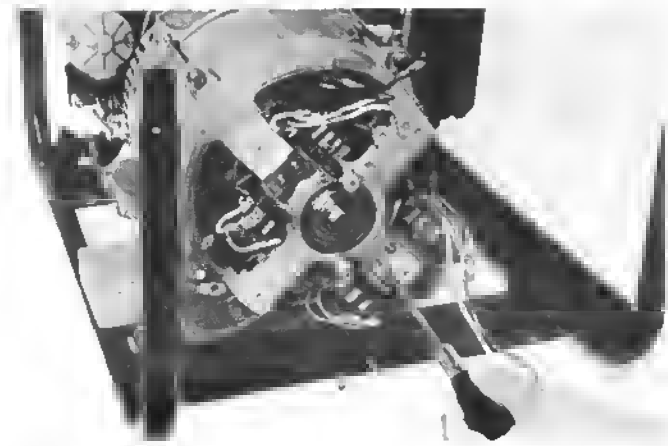


Wire Harness
1. Disconnect the ground terminal (2), connector (3), and crown terminal of diode stack (4).
2. Remove the lead wire clamp (1).
   (1) Lead Wire Clamp
   (2) Ground Terminal
   (3) Connector
   (4) Diode Stack

(When reassembling)
- Connect each terminal into the diode stack being careful of each pole.
- Be sure to connect the connector and ground terminal.
- Attach the wire harness to the generator part through the rubber grommet, and bind each lead wire.
- Securely clamp the lead wires after wiring.

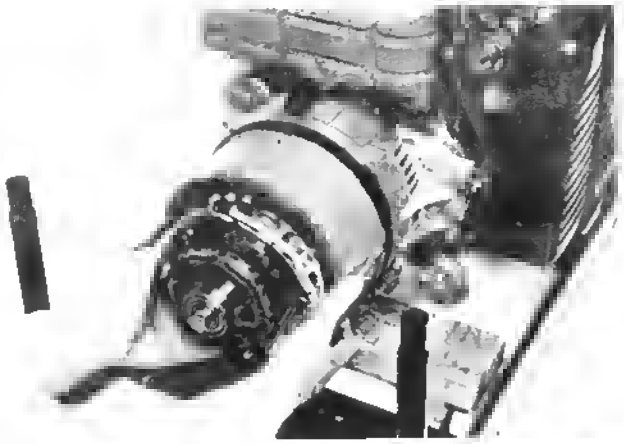
■IMPORTANT
- **Be careful of the poles.**
- **Be sure to insert connect terminal into the diode stack one.**
- **After clamping, avoid pressing the wiring by hand so that the wiring does not come into contact with the rotary part and stator winding.**
- **Securely insert the wire harness tube into the rubber bushing.**





Diode Stack
1. Remove the four diode stack.

(When reassembling)
- Set the diode stack to end bracket.



End Bracket and Stator Ass'y

1. Remove four through bolts, and remove the rubber vibration insulator retaining nut.
2. Lift the generator, put a stand underneath as shown, and the end bracket.
3. Remove the stator ass'y.

■ IMPORTANT

- **While disassembling, carefully handle the heavy end of it. It may fall or hurt your hand.**
- **Protect the winding from damage and carefully place it in a clean and safe place.**

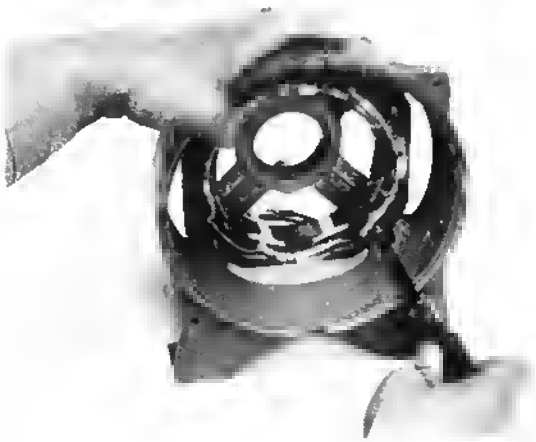
(When reassembling)

- Fit the bracket stator ass'y into the fitting hole of the rotor bearing and front bracket, and assemble. Tap the end bracket to insert the bracket stator ass'y with a wood hammer.
- Before assembly, check whether the brush holder is removed.
- Tighten four through bolts to specified torque.

Tightening torque	Stator through bolt	5.9 to 8.8 N·m 0.6 to 0.9 kgf·m 4.3 to 6.5 ft-lbs

■ IMPORTANT

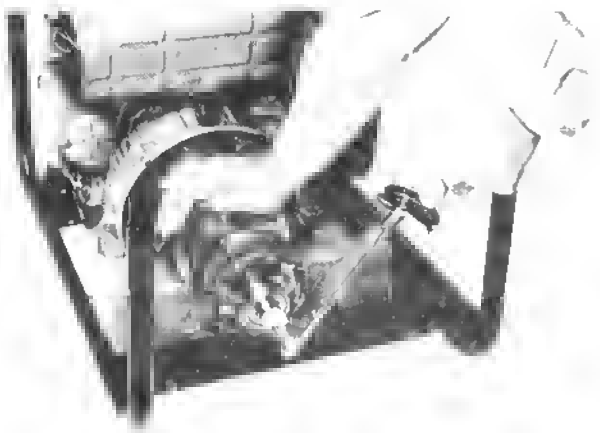
- **Remove dirt on the fitting parts and the outer circumference of the bearing.**
- **Carefully handle the winding so as not to damage it.**



(When reassembling)

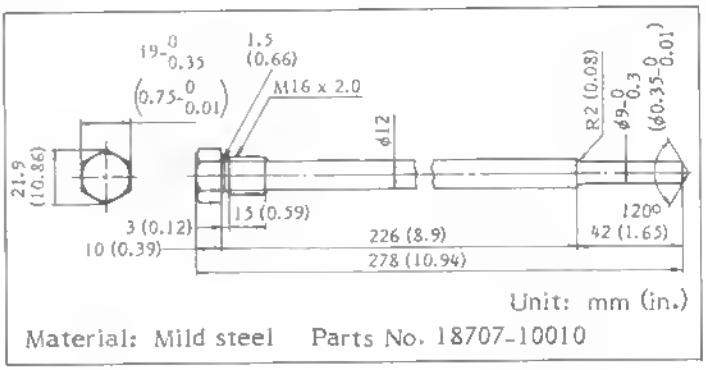
- Install the exciter stator into the end bell.

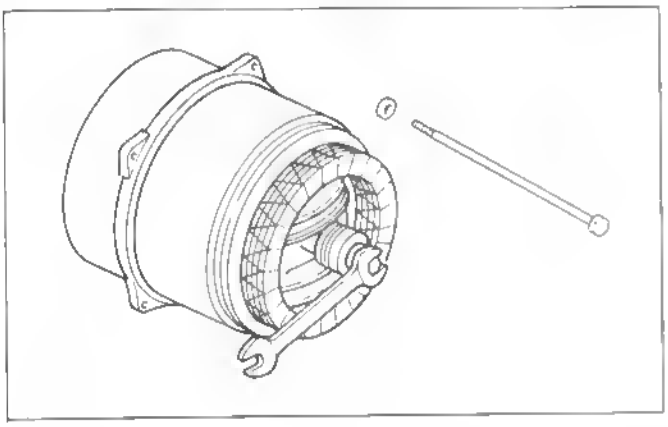
8. DISASSEMBLING AND ASSEMBLING



Rotor Ass'y

1. Take out rotor center bolt with a 19mm wrench.

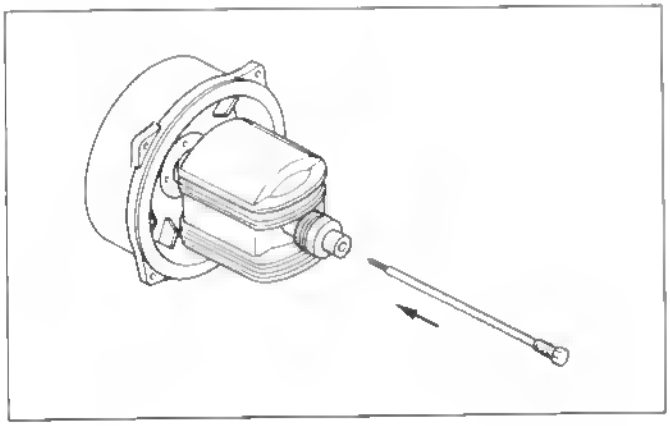


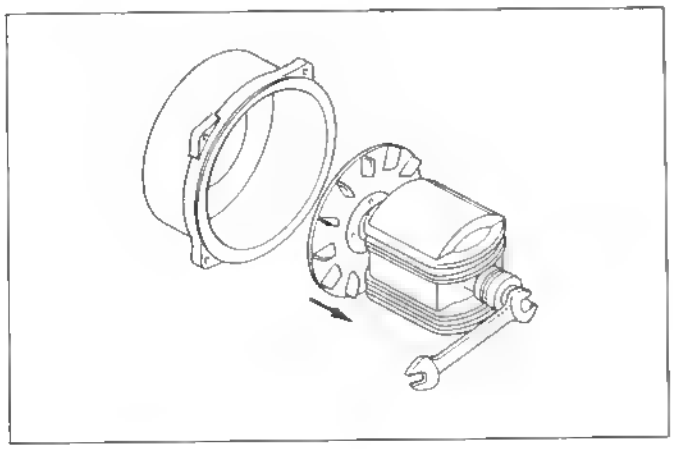


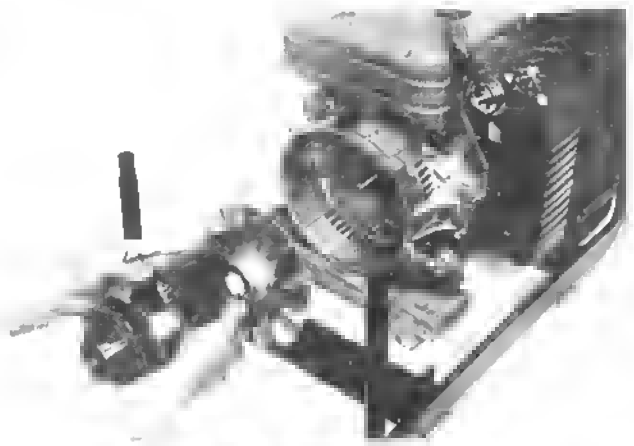
2. Insert a rotor draw bolt (Code No. 18707-10010).
3. Rotor ass'y is pulled out from the crankshaft by tightening rotor draw bolt with a 24mm wrench.

■IMPORTANT

- Use the rotor draw bolt (special tool) to disassemble the rotor ass'y.
- Carefully handle the heavy rotor when removing. It may fall and hurt your hands.
- Carefully handle and place the winding so as not to damage it.
- If damaged, the winding may prevent generation.



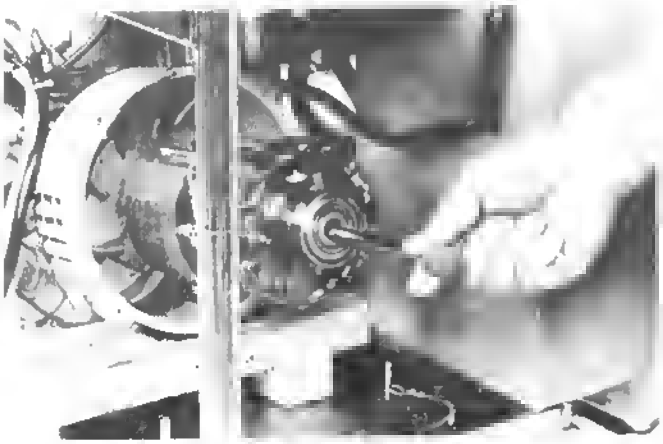


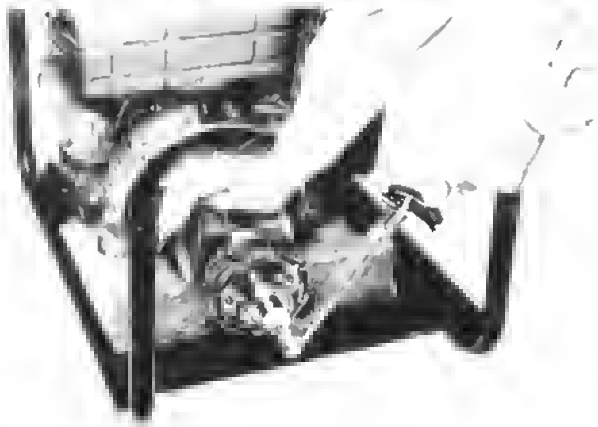


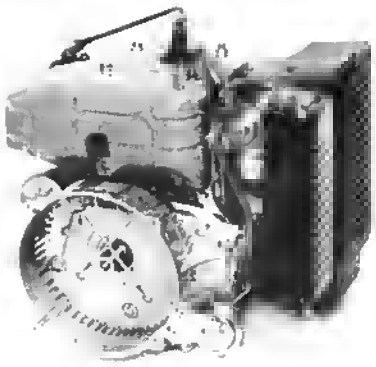
(When reassembling)
- Clean the tapered part of dirt and oil.
- Fit the rotor ass'y onto the crankshaft.

Tightening torque	Rotor center bolt	40 to 50 N·m 4.0 to 4.5 kgf·m 29 to 36 ft-lbs

■ IMPORTANT
- If dirt or oil remains on the tapered part, expected output may not be realized.
- Handle the windings with care so as not to damage them.







Front Bracket
1. Remove four front bracket mounting bolts to remove the front bracket.

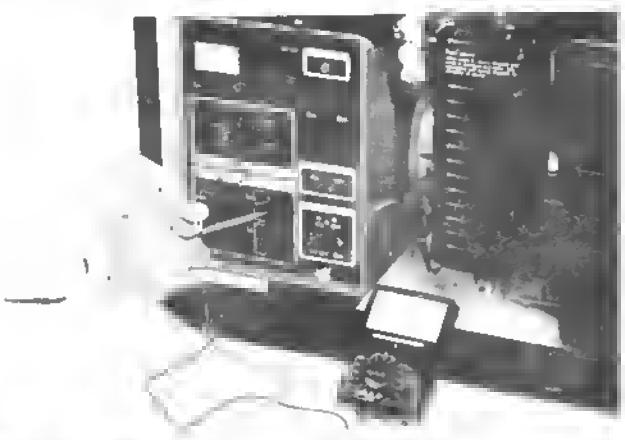
(When reassembling)
- Properly fit the front bracket to the outer hole circumference of the engine oil seal.
- Assemble the front bracket, with the arrow mark facing upward.

Tightening torque	Front bracket mounting bolt	17.7 to 21.6 N·m 1.8 to 2.2 kgf·m 13.0 to 16.0 ft-lbs

9. INSPECTION

■ NOTE
- Regarding checking coil resistance, milli ohmmeter is preferable for the type under 1 ohm value.

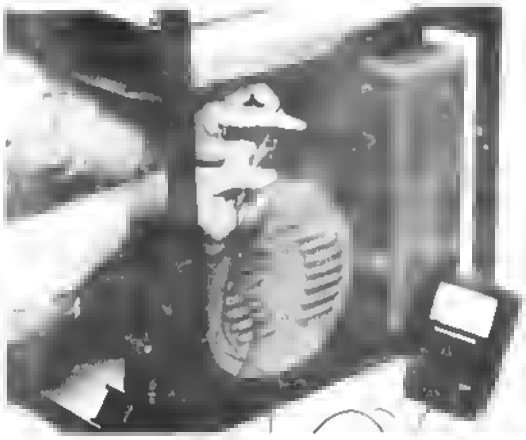
9-1 VOLTAGE BETWEEN TERMINAL OF EACH PART UNDER NORMAL CONDITIONS (AT NO LOAD)



AC Output Terminal

1. Measure voltage between terminals of AC output receptacles for 120 V with a voltmeter.
2. If voltage is OV, it indicates a disconnection in the AC output circuit (CON4 - NFB -connector). Check continuity between those elements, with (+) or (-) terminal of the battery cable disconnected.

Voltage	Factory spec.	AC 115 to 138 V



Main Coil Terminal

1. Measure voltage between connector terminals (between red and blue) (between white and black) with a voltmeter.
2. If voltage is 0 V, it indicates a disconnection in the main coil circuit (connector - Rel - M.C). Check continuity between those elements, with (+) or (-) terminal of the battery cable disconnected.

Voltage	Factory spec.	AC 120 V

DC Output Terminal

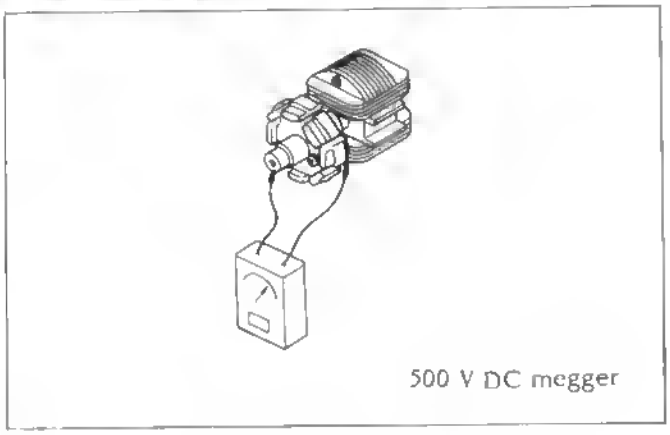
1. Measure voltage between terminals of DC output receptacle with a voltmeter.
2. If voltage is 0 V, it indicates a disconnection in the DC output circuit (CON1 - CB - connector). Check continuity between those elements, with (+) or (-) terminal of the battery cable disconnected.

Voltage	Factory spec.	DC 9 to 12 V

Charging Coil Terminal (DC-C)

1. Measure voltage between connector terminals (between wiring white / red and white / blue) with a voltmeter. ⊕ ⊖
2. If voltage is 0 V, it indicates a disconnection in the charging coil circuit(connector-Re3 -D-C). Check continuity between those elements, with ⊕ or ⊖ terminal of the battery cable disconnected.

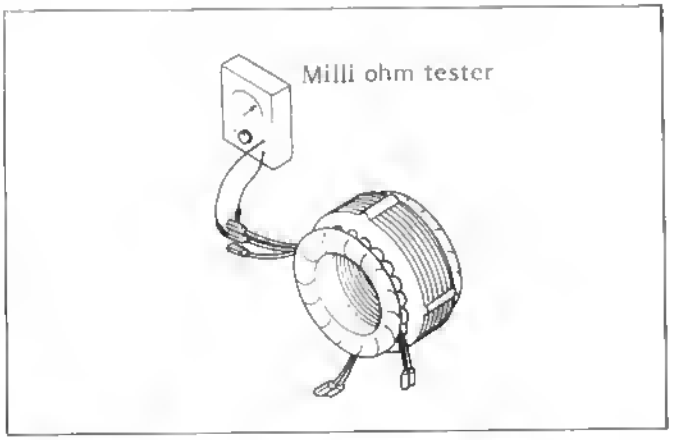
Voltage	Factory spec.	DC 12 V



Winding Check

■ Testing for grounds

Using a 500 V DC megger, test each winding for shorts to laminations. A reading less than 10 M at hot state indicates a ground.



■ Testing for open or shorted windings

Test for continuity between coil leads, all pairs should have equal resistance. Use a milli ohm tester for this test.

All resistances should be ±10% of value shown at 20°C (68°F).

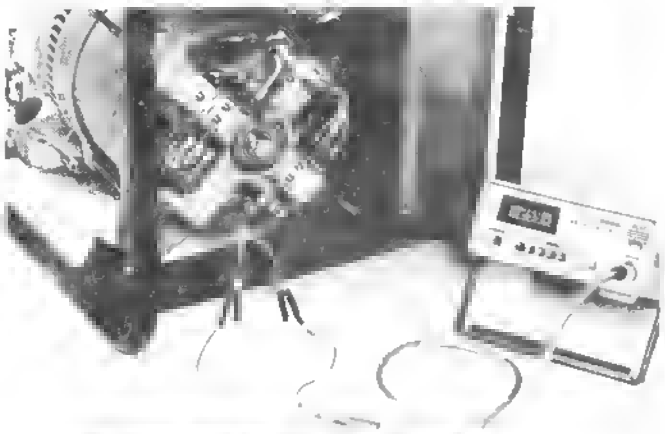
If any windings are shorted, open or grounded, replace the winding.

9-2 STATOR ASS'Y

Main Coil (M-C)

1. Disconnect the connector and measure winding resistance between lead wire (between wiring red of 6P coupler and white of diode stack Re1) with an ohmmeter.
2. If the specified value is not indicated, the main coil is faulty.

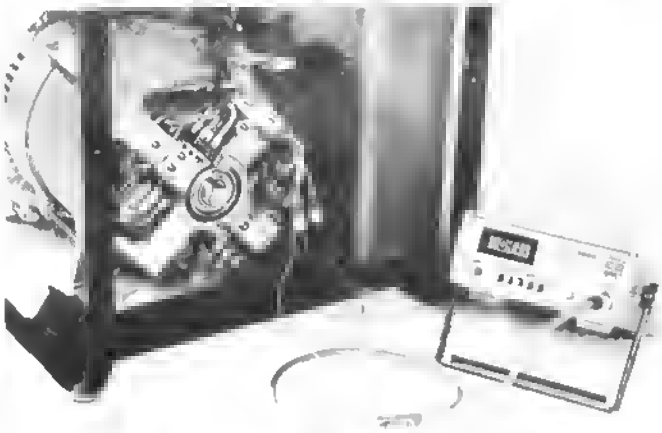
Resistance	Factory spec.	0.25Ω ±10%



Sub Coil (SB.C)

1. Measure winding resistance between terminals of diode stack Re2 (between white/yellow and white/brown) with an ohmmeter.
2. If the specified value is not indicated, the battery charging coil is faulty.

Resistance	Factory spec.	0.27Ω ±10%

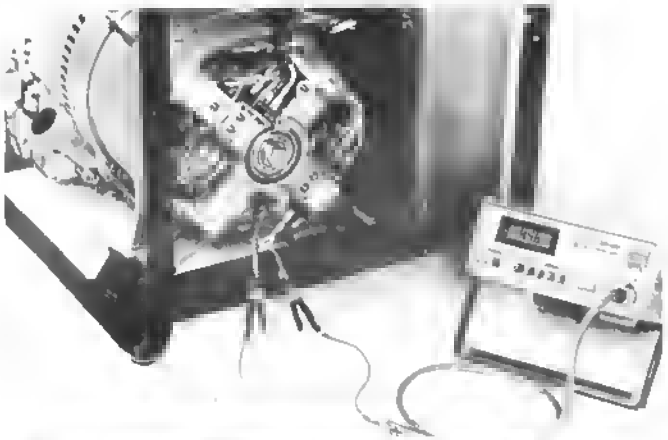


Charging Coil (DC.C)

1. Measure winding resistance between terminals of diode stack Re3 (between wiring white/yellow and white/yellow) with an ohmmeter.
2. If the specified value is not indicated, the charging coil is faulty.

Resistance	Factory spec.	0.044Ω ±10%

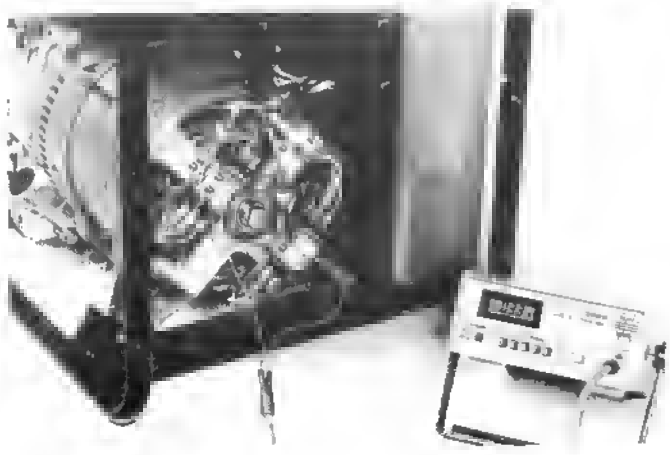
9-3 EXCITER FIELD COIL



Exciter Field Coil 1

1. Measure winding resistance between terminals of diode stack Re2 (between wiring violet and gray) with an ohmmeter.
2. If the specified value is not indicated, the exciter field coil-1 is faulty.

Resistance	Factory spec.	4.5Ω ±10%



Exciter Field Coil 2, 3

1. Measure winding resistance between terminals of diode stack Re1 (between wiring white/orange - white/black and between wiring brown/white - yellow) with an ohmmeter.
2. If the specified value is not indicated, the exciter field coil 2, 3 is faulty.

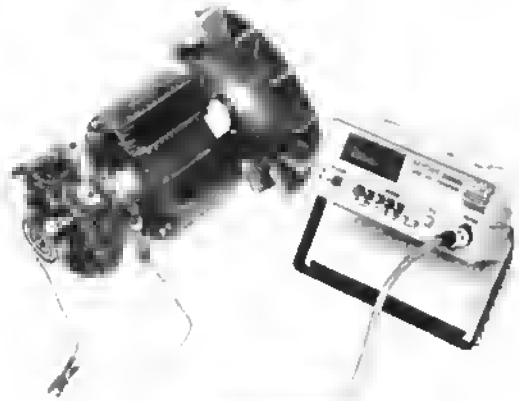
Resistance	Factory spec.	0.033Ω ±10%

9-4 ROTOR ASS'Y

Field Coil

1. Measure winding resistance between terminals of diode stack ((+) and (-) side of diode) with an ohmmeter.
2. If the specified value is not indicated, the field coil is faulty.

Resistance	Factory spec.	6.0Ω ±10%



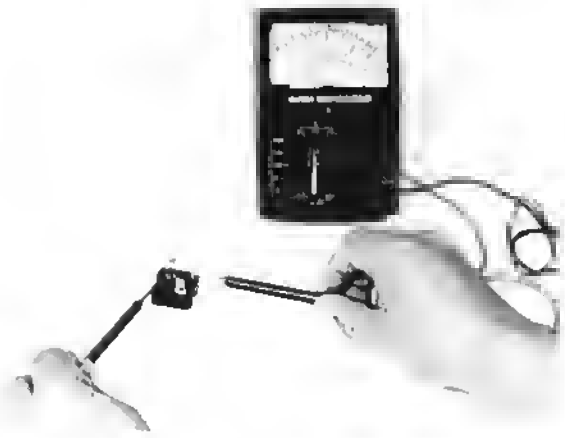
Exciter Armature

1. Measure winding resistance between terminals of diode stack with an ohmmeter.
2. If the specified value is not indicated, the exciter armature is faulty.

NOTE

- **In this check, be sure to detach wire from diode and measure.**

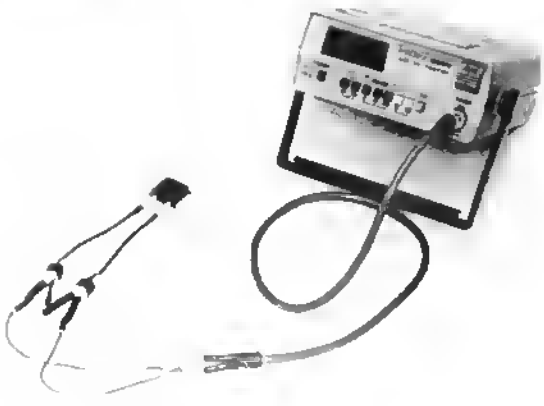
Resistance	Factory spec.	1.10Ω ±10%



Diode Stack

1. Disconnect the connector, crown terminals, and check for continuity.
2. Put tester probes (+) and (-) alternately onto a pair of adjacent terminals with an ohmmeter.

	Tester probe (+)	Tester probe (-)	Tester pointer	
Rectifier symbol	AC terminal	+	Not drifting	Check each of two AC terminals.
	+	AC terminal	Drifting	
	AC terminal	-	Drifting	
	-	AC terminal	Not drifting	



Positive Thermistor

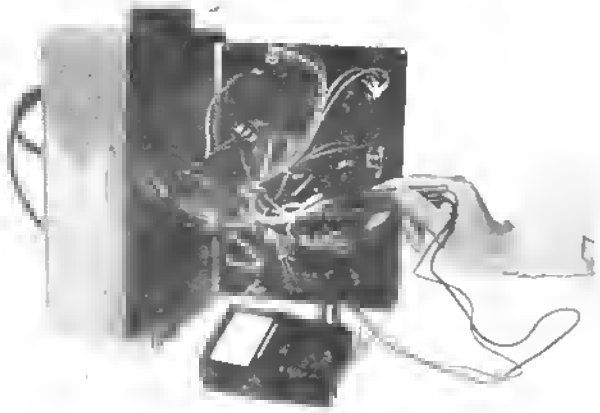
1. Disconnect the lead wire of positive thermistor and measure resistance.

Resistance	Factory spec.	4.7Ω ±30%

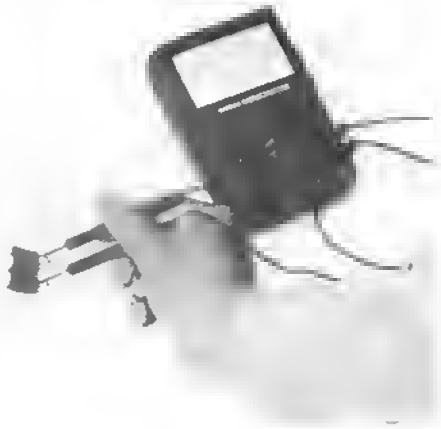
at 20°C (68°F)

9. INSPECTION

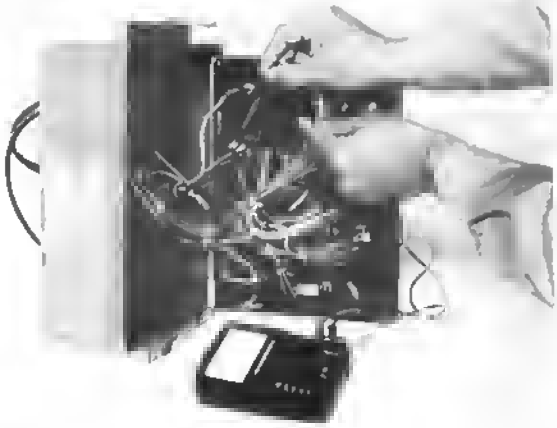
Toggle Switch



Circuit Breaker for DC

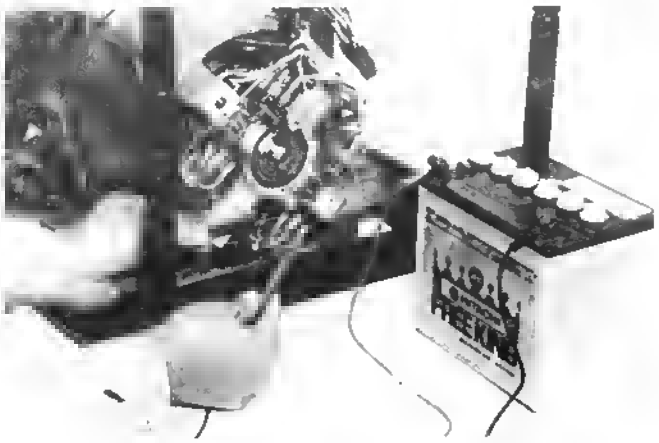


Starter Switch



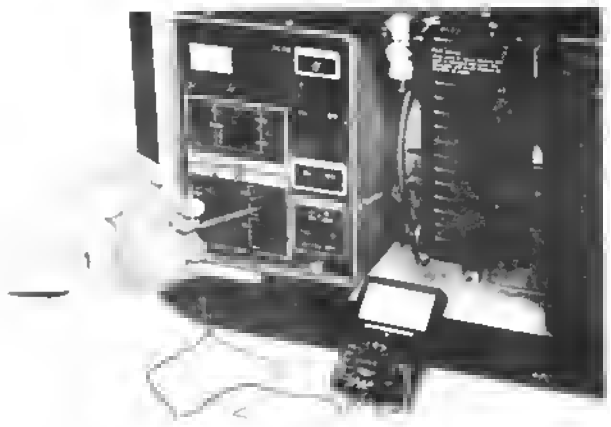
No Fuse Breaker for AC

A continuity check is used for diagnosing electric parts mentioned above. Some resistance shows when operating switch.
Infinity indicating that meter pointer does not move away from the left end of the scale means some kind of trouble.



■ **Flashing the field**
Using a twelve volt battery, momentarily flashing the exciter field is necessary when installing a new generator to restore residual magnetism. Connect battery ⊕ cable with gray and ⊖ cable with violet of diode Re2, respectively.

10. TROUBLE, DETECTION AND REMEDY

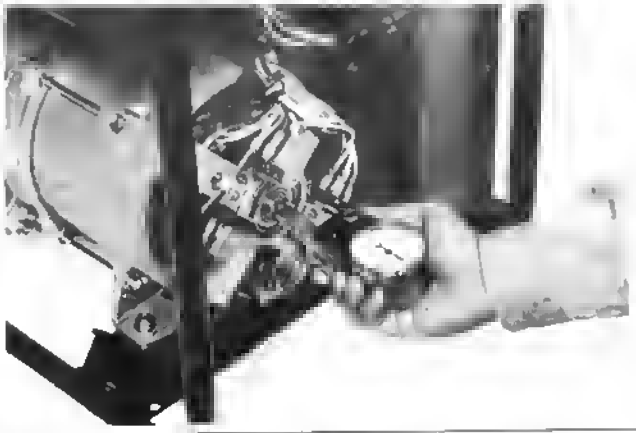
	Trouble	Checking	
Power is not taken out when a load is applied.	The voltmeter denotes rated value, but output voltage will not occur.	Measure voltage between terminals of the AC output receptacle with a voltmeter. (AC range: 250 V) 	
	*1 The voltmeter does not swing, and output voltage does not occur.	- as above -	

10. TROUBLE, DETECTION AND REMEDY

Measured value or operating condition	Probable cause	Remedy
Output voltage: 0 V	NFB is turned "OFF".	Turn the switch "ON". If the circuit turns "OFF" again, check for overload and short-circuited wiring and remove trouble. Turn the switch "ON".
	Faulty receptacle	Repair or replace.
	Faulty NFB contact	Replace.
	Disconnected wiring. (inside control box)	Check wiring and repair.
Output voltage: 0 V	Generator output connecter is disconnected.	Connect.
	Disconnected output (main) coil	Replace or repair stator.
	Broken diode stack for main coil (Si2)	*2 Replace.
	Disconnected wiring	Repair.
Low output voltage (3 to 8 V)	Disconnected rotor coil	Repair or replace.
	Disconnected wiring of exciter armature coil	Repair or replace.
	Broken diode stack for rotor coil	*2 Replace.
Low output voltage (10 to 15 V)	Disconnected sub-coil	Replace or repair.
	Broken diode for sub-coil (Re3)	*2 Replace.

■ NOTES
- As to items marked *, locate cause according to "11. ORDER FOR CHECKING TROUBLE SOURCE", on page 42-46.
- Accept or reject each part according to the list.

10. TROUBLE, DETECTION AND REMEDY

	Trouble	Checking	
Load is taken out but involves trouble.	NFB is broken.	Measure voltage between terminals of AC output receptacle with a voltmeter. (AC range: 250 V) 	
	Rated output is not taken out.	Measure revolution fluctuations or frequency fluctuations at no load and under load (with a tachometer or frequency meter). 	
	Rated output is not taken out.	Measure voltage between terminals of the AC output receptacle with a voltmeter (AC range: 250 V). 	

10. TROUBLE, DETECTION AND REMEDY

Measured value or operating condition	Probable cause	Remedy
Normal output voltage: 115 to 138 V	Faulty load circuit	Remove trouble (overload or short-circuit) and turn NFB "ON".
Normal engine revolutions Reduction in revolution or frequency): within 10%	Improperly connected wiring	Repair.
	Improperly contacted connector	Repair.
	Improperly contacted diode	Repair.
Excess engine revolution. Reduction in revolution (or frequency): 10% or more	Excess load	Locate cause (overload) and remove.
	Reduced engine output	Repair engine.
	Faulty engine governor	Repair engine.
Output voltage: 100 V or less	Reduced engine revolution (3000 r.p.m. or less)	Turn accelerating lever to "RUN".
	Stator coil short-circuit	Repair or replace.
	Sub-coil short-circuit	Repair or replace.
	Rotor coil short-circuit	Repair or replace.
	Broken diode stack for main coil or sub-coil (Re1, Re2)	Replace.

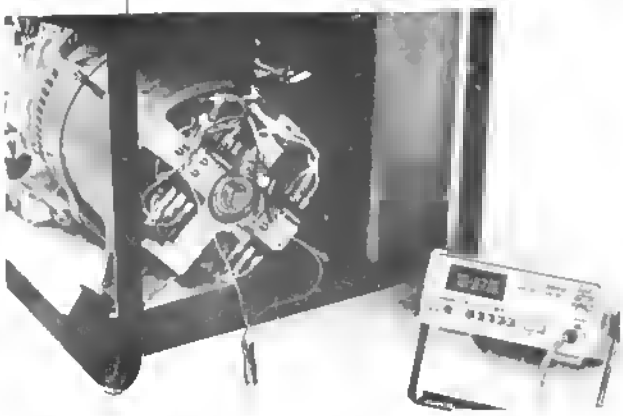
■ NOTES
- As to items marked *, locate cause according to "11. ORDER FOR CHECKING TROUBLE SOURCE", on page 42-46.
- Accept or reject each part according to the list.

11. ORDER FOR CHECKING TROUBLE SOURCE

11-1 NO AC VOLTAGE IS PRODUCED

No voltage is produced.

Measure winding resistance of exciter field coil 2 and 3.
(Resistance value: 0.033Ω
White/orange - white/black for EFC2
Brown/white - yellow for EFC3)



Resistance value is infinity (∞).

Exciter field coil 2 and 3is disconnected.

Broken silicone diode

Measure winding resistance of main coil (M.C) at output connector of generator.
(Resistance value: 0.25Ω)
(Red - Blue)
(Black - White)

Resistance value is infinity (∞) or less than resistance value of M.C.

Stator coil is disconnected or short-circuited.

11. ORDER FOR CHECKING TROUBLE SOURCE

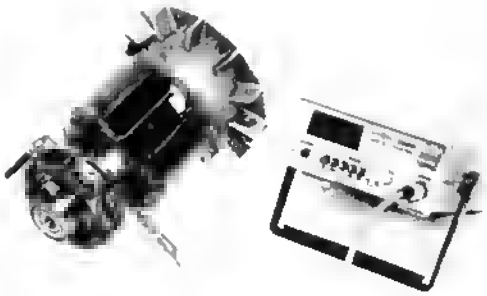
Low AC voltage

AC voltage is 3 to 8 V.

Measure winding resistance of rotor coil and exciter armature coil.

Rotor coil resistance value: 6.0Ω

Exciter armature coil resistance value: 1.10Ω



Check conduction across diode stack of main coil. Refer to item "9. INSPECTION".

Resistance value is infinity (∞).

Broken silicone diode

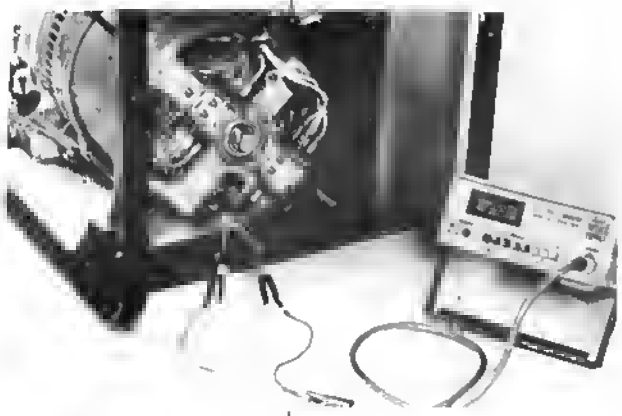
Rotor coil or exciter field coil is disconnected.

11. ORDER FOR CHECKING TROUBLE SOURCE

Low AC voltage

AC voltage is 10 to 15 V.

Measure winding resistance of Sub coil (SB.C)
(Resistance value: 0.27 Ω)
(White/yellow - white/brown)



Resistance value is infinity (∞).

Sub-coil is disconnected.

Check conduction across diode stack of sub coil. Refer to item "9. INSPECTION".

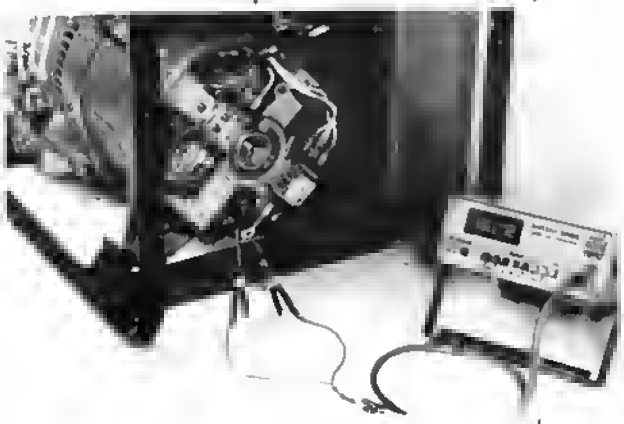
Resistance is within specification.

Resistance is not within specification.

Broken silicone diode.

11. ORDER FOR CHECKING TROUBLE SOURCE

Measure winding resistance of Exciter field coil 1 (EFC1).
(Resistance value: 4.5Ω)
(Violet - grey)



Should be conducted.

Resistance value is infinity (∞).

Exciter field coil 1 is disconnected.

11. ORDER FOR CHECKING TROUBLE SOURCE

11-2 DC VOLTAGE IS NOT PRODUCED

DC voltage is not produced.

Turn generator to specified r.p.m., and measure voltage at DC output receptacle.

DC voltage is 0 V.

Check whether NFB on DC side is turned "OFF".

NFB is not turned "OFF".

Measure DC voltage (between wiring white/red and white/blue) at generator connector.

Measure voltage: DC 9 to 12 V *1

1 Receptacle or switch is improperly contact.
2 Wiring inside control box is disconnected.

Measured voltage is less than about 50% of voltage marked *1.

Measure AC voltage.

AC voltage is normal.

Faulty charging diode stack Re3

Measured voltage: 0 V

AC voltage is abnormal.

Refer to item "AC voltage is not Produced".

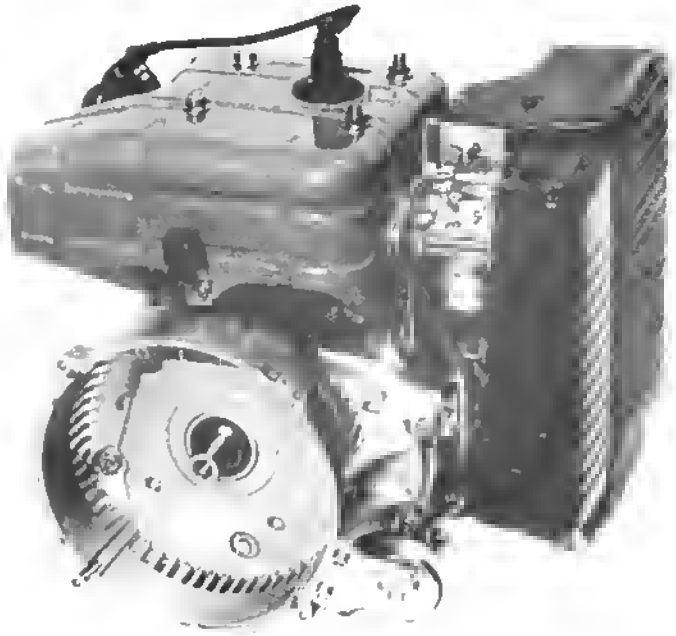
Measure the winding resistance of DC coil.
(Resistance value: 0.044Ω)
(White/yellow - White/yellow)

Check conduction across diode stack of DC coil.
Refer to item "9. INSPECTION".

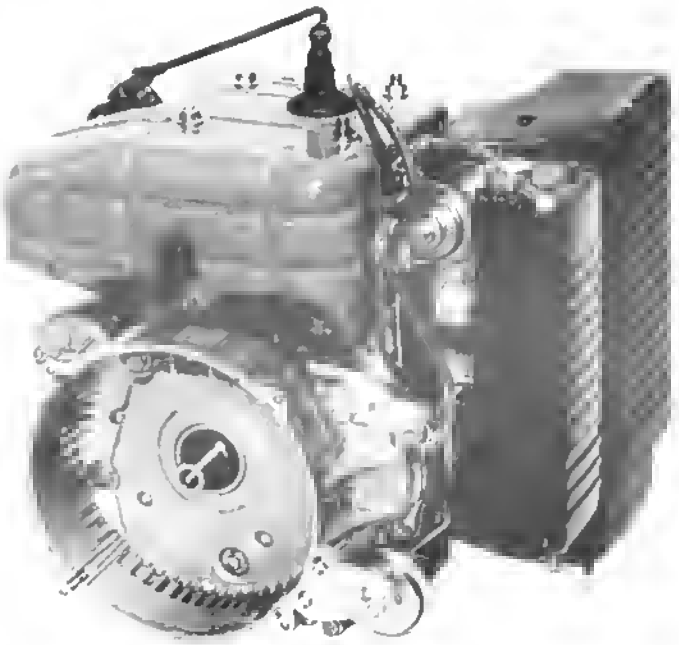
Resistance value is infinity (∞).

DC coil is disconnected.

ENGINE



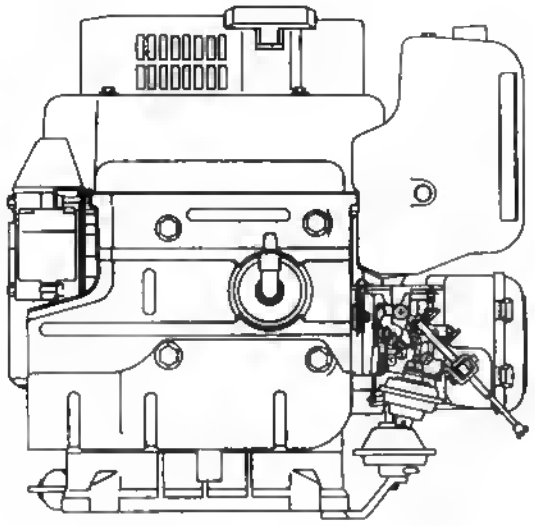
Hand starter

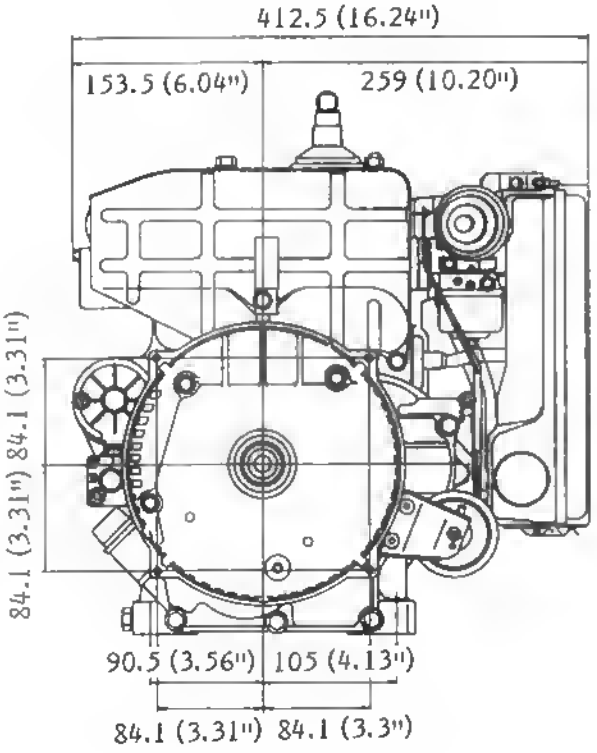


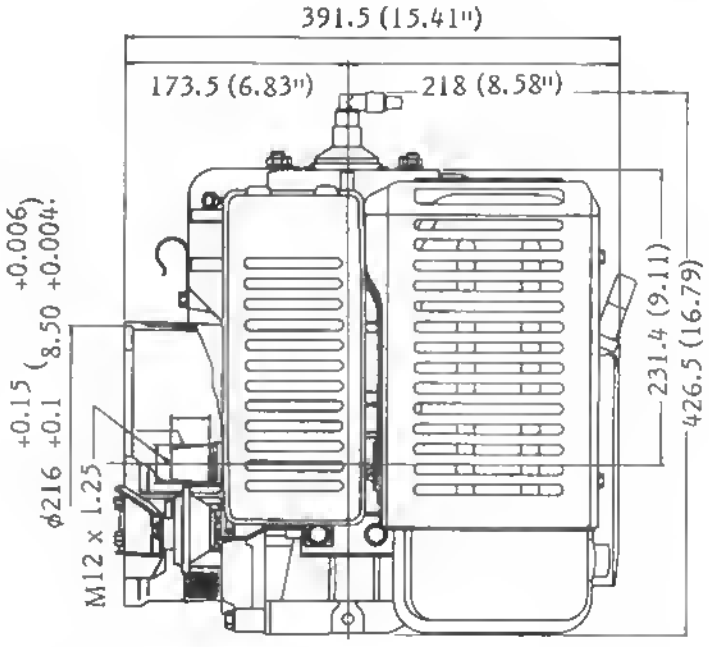
With Electric starter

DIMENSIONS

B model
(with electrical starter)







Unit: mm (in.)

2. SPECIFICATIONS

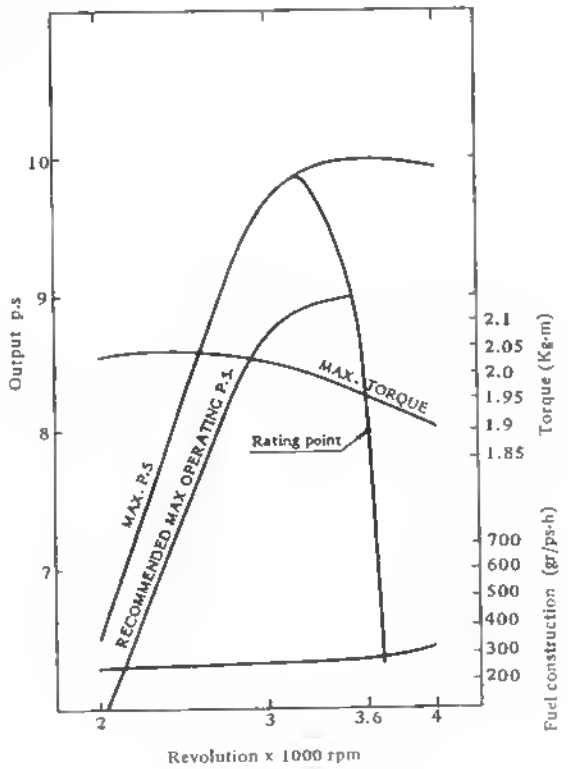
ENGINE

	GS410(B)-DG-ONAN
Type	4-stroke, side valve, forced air cooled
Displacement	412 cc (25.1 cu.in)
Bore x Stroke	86 x 71 mm
Compression ratio	6.6 : 1
Max. horsepower	10 PS/3,600 rpm
Max. torque	2.3 kg-m/2,400 rpm
Rated output	8 PS/3,600 rpm
Fuel consumption	1.61 lit/h (0.43 US gal/h)/3,600 rpm
Lubrication system	Forced splash
Governor	Centrifugal
Ignition system	C.D.I.
Ignition timing	BTDC20°
Spark plug	BPR6HS (NGK), L-87Y (Champion)
Starting system	Recoil starter
Stopping system	By grounding
Air cleaner	Wet type
Fuel	Regular unleaded gasoline
Lubricant capacity	1,100 cc (1.16 US qt)
Reduction system	Direct drive
Revolution direction	Left (faced at drive shaft)

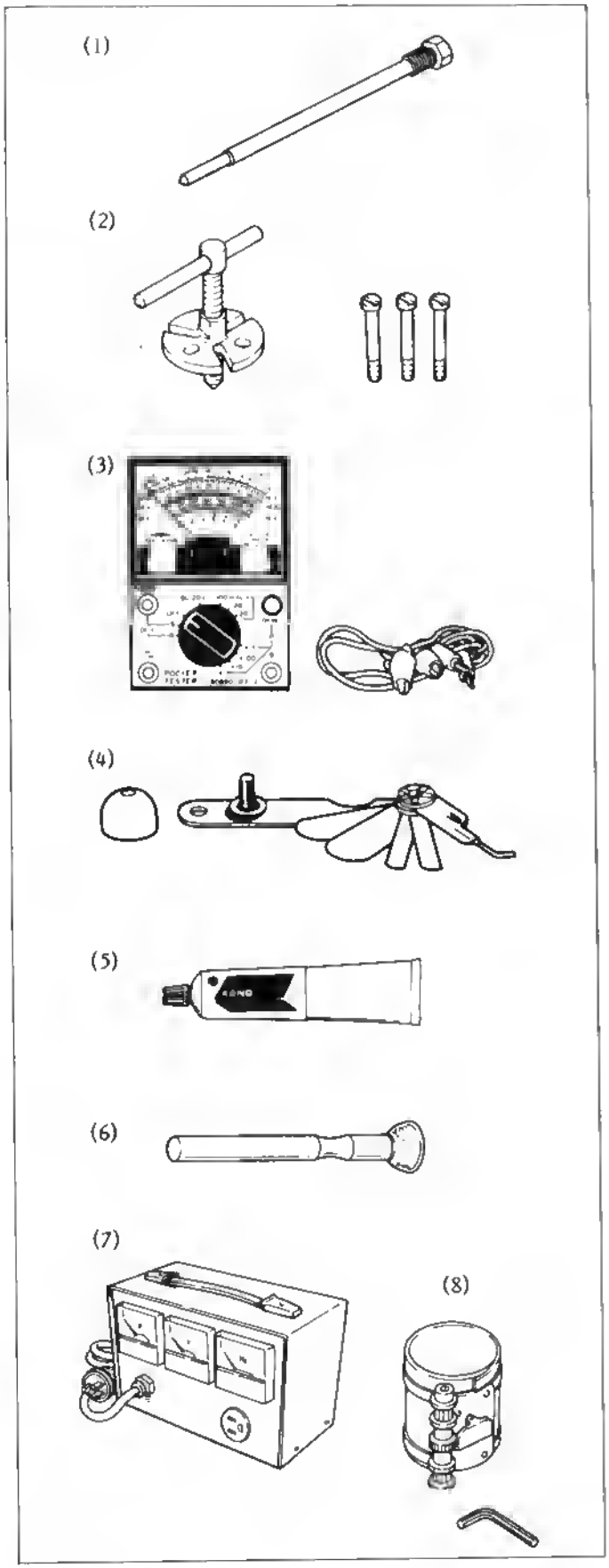
DIMENSIONS

	GS410(B)-DG-ONAN
Length	416mm (16.4in)
Width	401mm (15.8in)
Height	511mm (20.12in)
Weight	35 kg (77.2 lb)

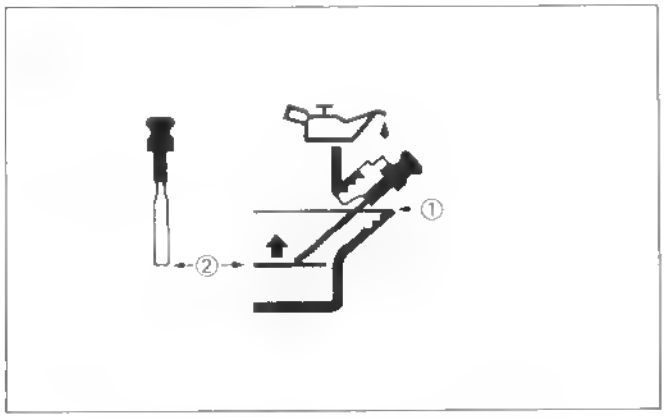
PERFORMANCE CURVE



SPECIAL TOOLS & TESTERS



No.	Tool Name		For general Part No.
1	Rotor puller bolt		18707-10010
2	Magneto puller		17701-99081
3	Pocket tester		
4	Service gauge (Thickness gauge)		
5	Gasket cement		
6	Valve lapper		
7	GENERATOR TESTER	120 V area 240 V area	
8	Piston ring compresser		



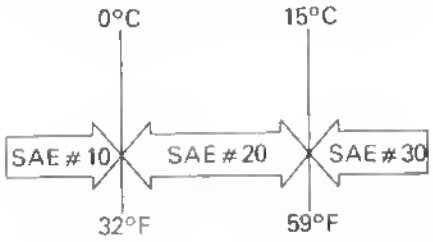
① Upper level ② Lower level

Engine oil

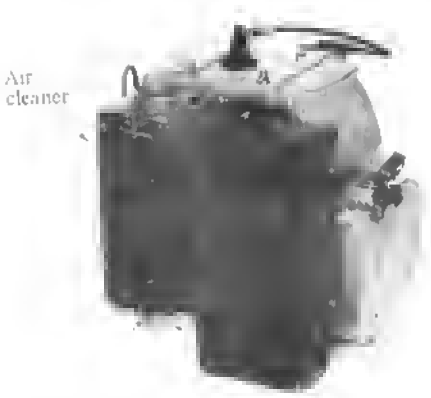
(1) Checking the oil level
Place the engine on a level ground surface, remove the oil plug, and make sure the oil is filled up to the oil plug hole.

(2) Oil refilling
Place the engine on a level ground surface, remove the oil plug, and add oil.

Recommended oil: 4-stroke engine oil API Service Classification SE or SF, if not available, SD



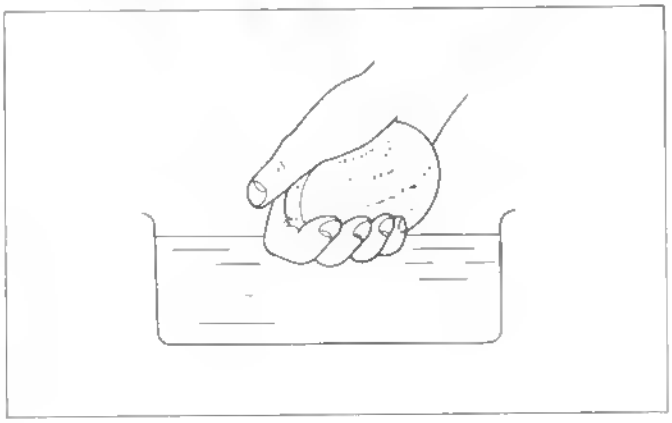
Engine oil capacity
GS410(B)-DG-ONAN:
1,200 cc (1.27 us qt, 0.97 IMP qt)

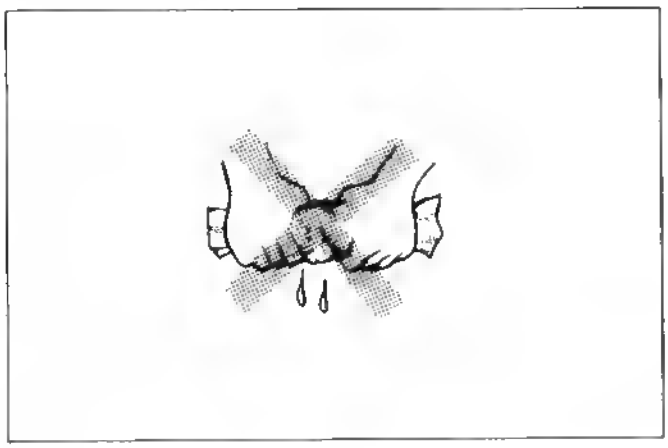


Air cleaner

Check the air cleaner element for fouling or clogging. If it is fouled or clogged, hard starting or excessive fuel consumption will result. Thoroughly clean the element.

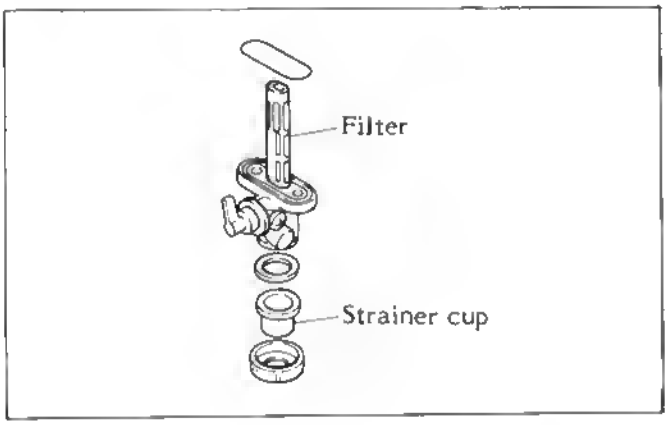
Remove the air cleaner cover and remove the element.
Wash the element in detergent and water. Dry thoroughly. Dip it in engine oil.
Lightly squeeze it to remove excess oil and install.
Apply a coat of grease to the outside edge of the element.





⚠CAUTION

Never twist the element as illustrated to the left, or it may break.

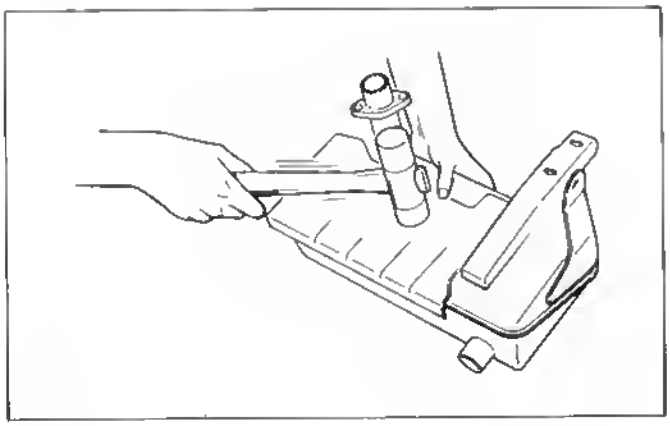


Fuel strainer

(1) Drain the fuel tank and remove the fuel hose from the fuel cock.
(2) Remove the strainer cup and filter. Clean out any dirt and particule.
(3) After installing the removed parts, check for fuel leakage by moving the fuel cock lever to OPEN and CLOSED.

⚠WARNING

Fuel presents the hazard of fire or explosion which can cause severe personal injury or death. Proceed with care.

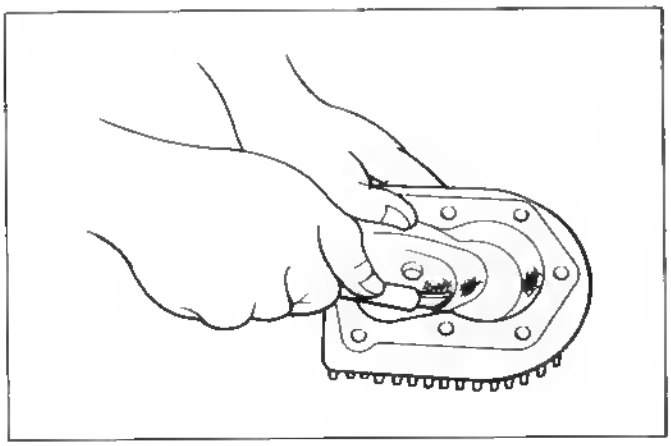


Muffler

(1) Remove the muffler.
(2) Tap on the muffler in the area shown in the illustration.

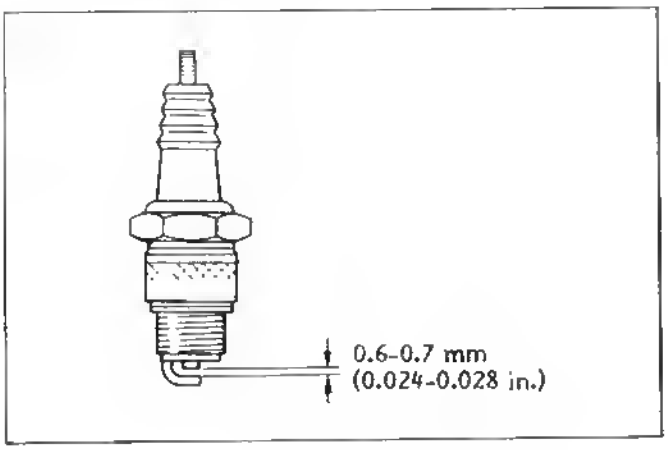
⚠CAUTION

To clean, don't use a wire, or the noise damping material will come off, so damping effect will be reduced.



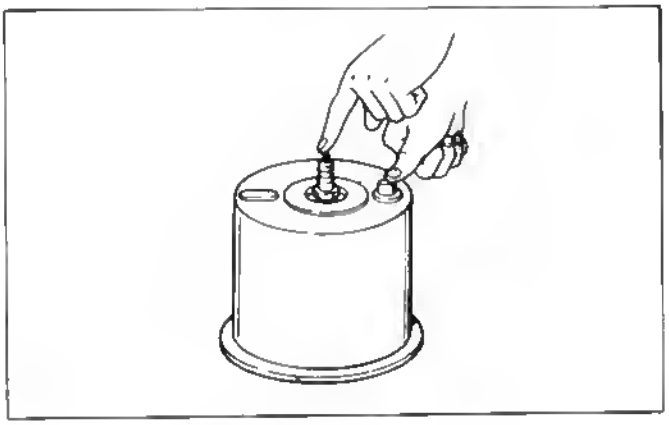
Cleaning the combustion chamber

Decarbonize the cylinder head and clean the cylinder head fins.

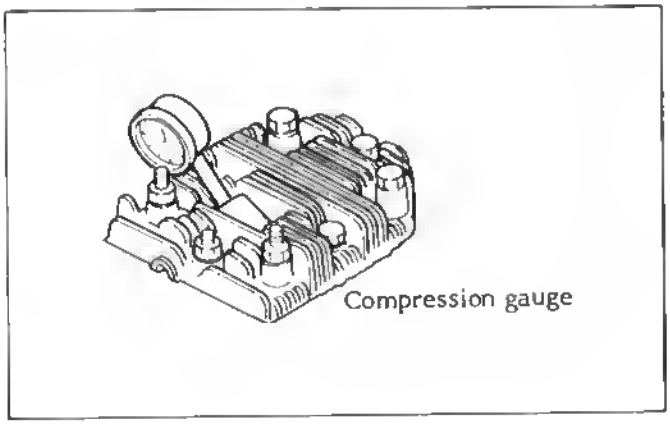


Spark plug

Standard plug: NGK BP-6HS Plug gap: 0.6 - 0.7 mm (0.024 - 0.028 in)

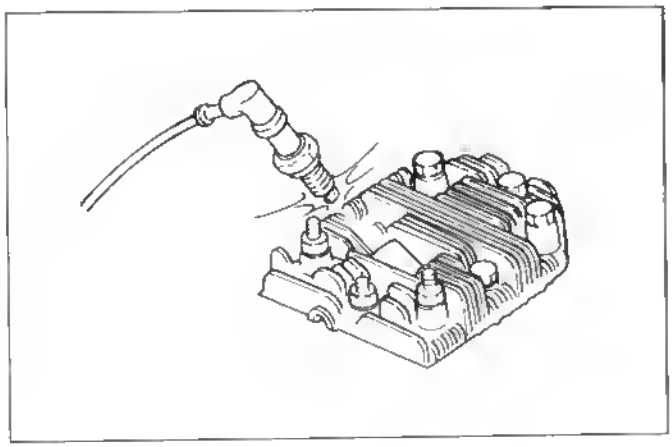


(1) The plug gap can be adjusted by bending the side electrode.
(2) Replace the spark plug if the center electrode is rounded at its edge.
(3) Replace the gasket, if deformed or damaged.
(4) Using a plug cleaner, clean or decarbonize the spark plug, if necessary.
(5) Decarbonize the threads and clean the insulator.
(6) To tighten the spark plug, first screw it in by hand and then turn it in 1/4 turn using a plug wrench.

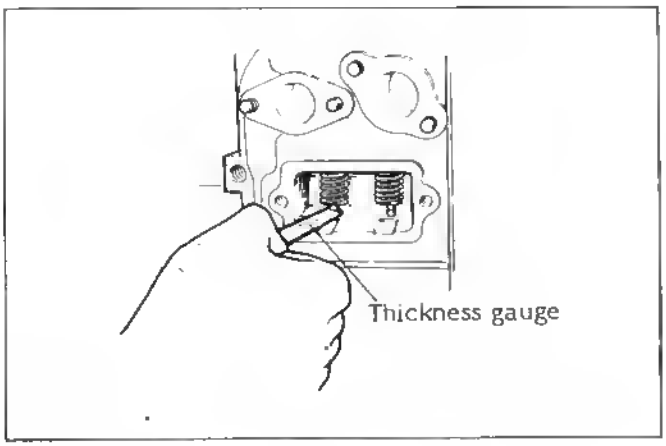


Compression pressure
(1) Remove the spark plug and install a pressure gauge in the spark plug hole.
(2) Pull the recoil starter briskly a few times and check a maximum reading of the pressure gauge.

STD	Limit
6 kg/cm^2 (85 psi)	5.5 kg/cm^2 (78 psi)

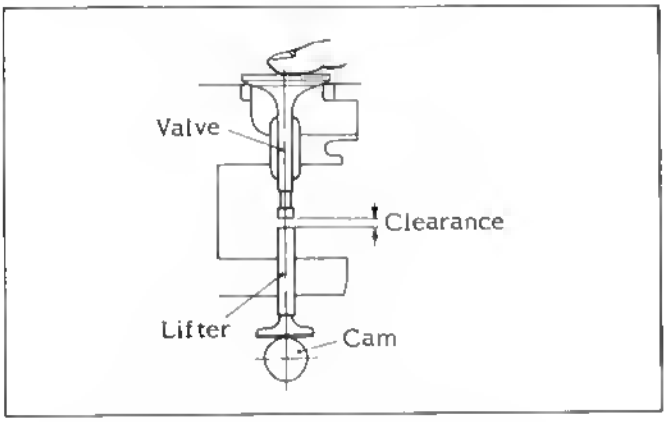


Checking sparks
(1) Remove the spark plug and install it onto the spark cap.
(2) Ground the side electrode to the cylinder, and pull the recoil starter so that spark takes place across the electrode gap.

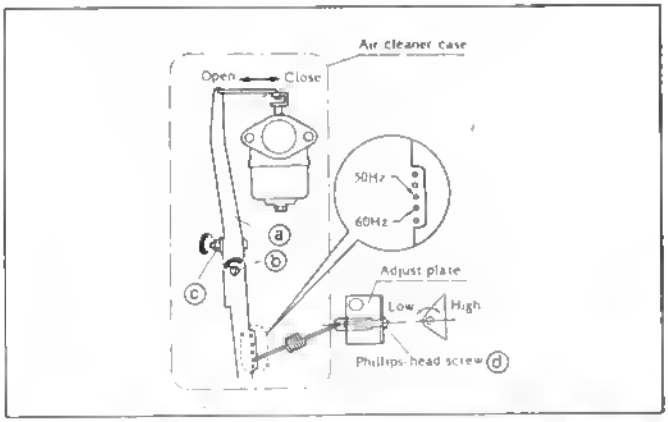


Adjustment
Valve clearance adjustment
The valve clearance should be measured with the piston at TDC on the compression stroke while the engine is cold.

NOTE:
Valve clearance
EX . . . . . 0.20 - 0.30 mm (0.0079 - 0.0118 in)
IN . . . . . 0.10 - 0.20 mm (0.0039 - 0.0079 in)

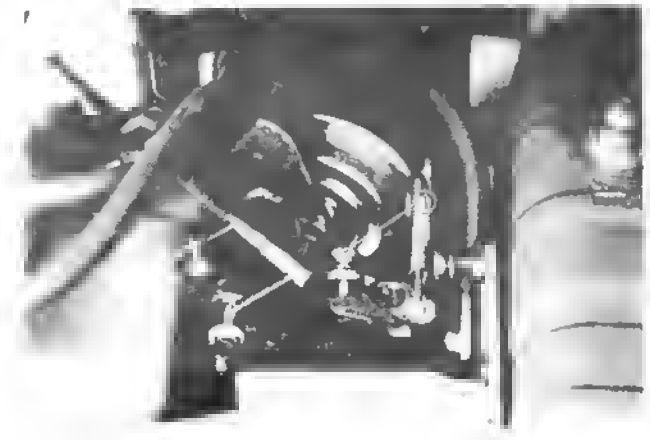


(1) If the valve clearance is too small, grind the valve stem end with a grinder.
Be careful so that the stem end is ground squarely.
(2) If the valve clearance is too large, the valve stem end is excessively worn and should be replaced.



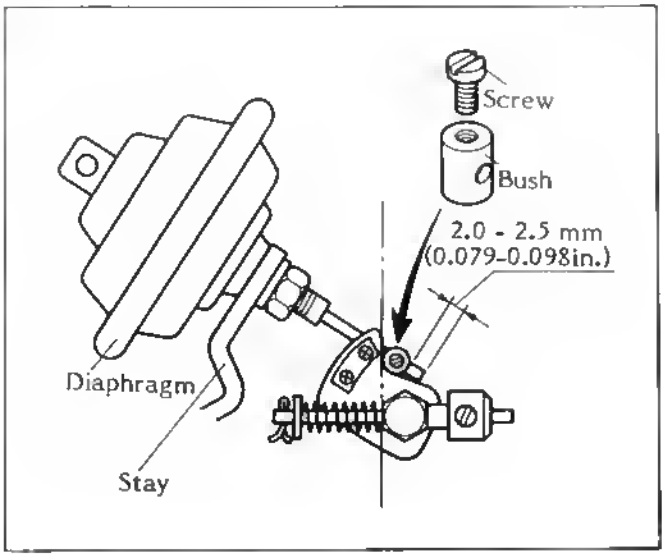
Governor adjustment
(1) Loosen the lock nut (c) and move the arm (a) all the way to the left to fully open the carburetor throttle.
(2) Insert a slotted-head screwdriver into the slit in the governor shaft (b), and turn it counterclockwise.

Voltage adjustment (Frequency adjustment)
Turn the Phillips-head screw (d) clockwise to increase engine speed. Turning counterclockwise decreases speed.

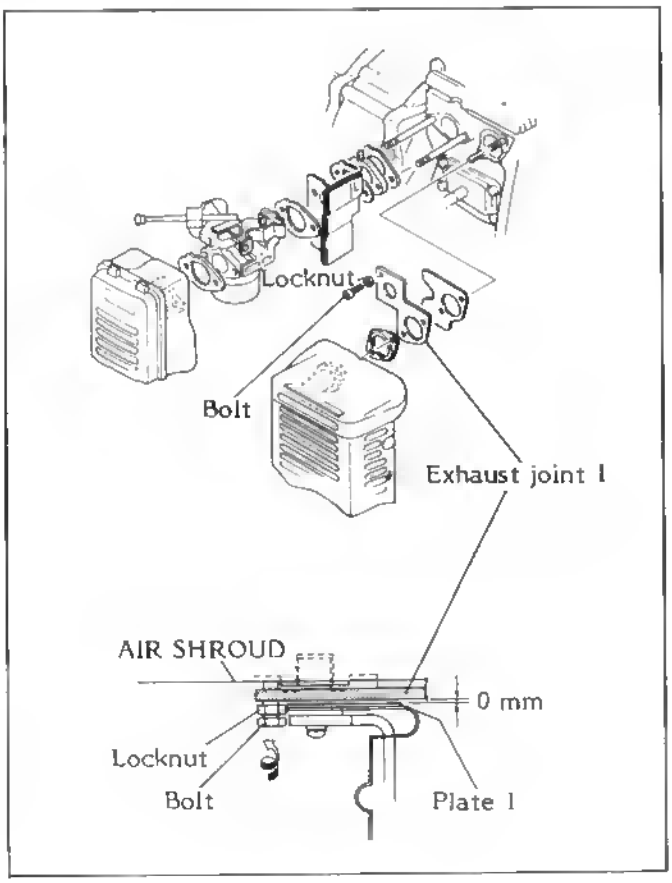


Economy idle adjustment (for "B" model)
(1) After warming up the engine under no load, set the economy idle switch to the "ON" position.
(2) Set the engine speed at 2,050 ± 50 rpm with the low idle adjusting bolt.
(See figure.)

(1) Adjusting volt



Diaphragm setting (for "B" model)
To set the diaphragm on the carburetor body, install the diaphragm on the stay and then set the bush 2.0-2.5 mm (0.079 - 0.098 in.) off the end of the diaphragm shaft with screw in the following manner:



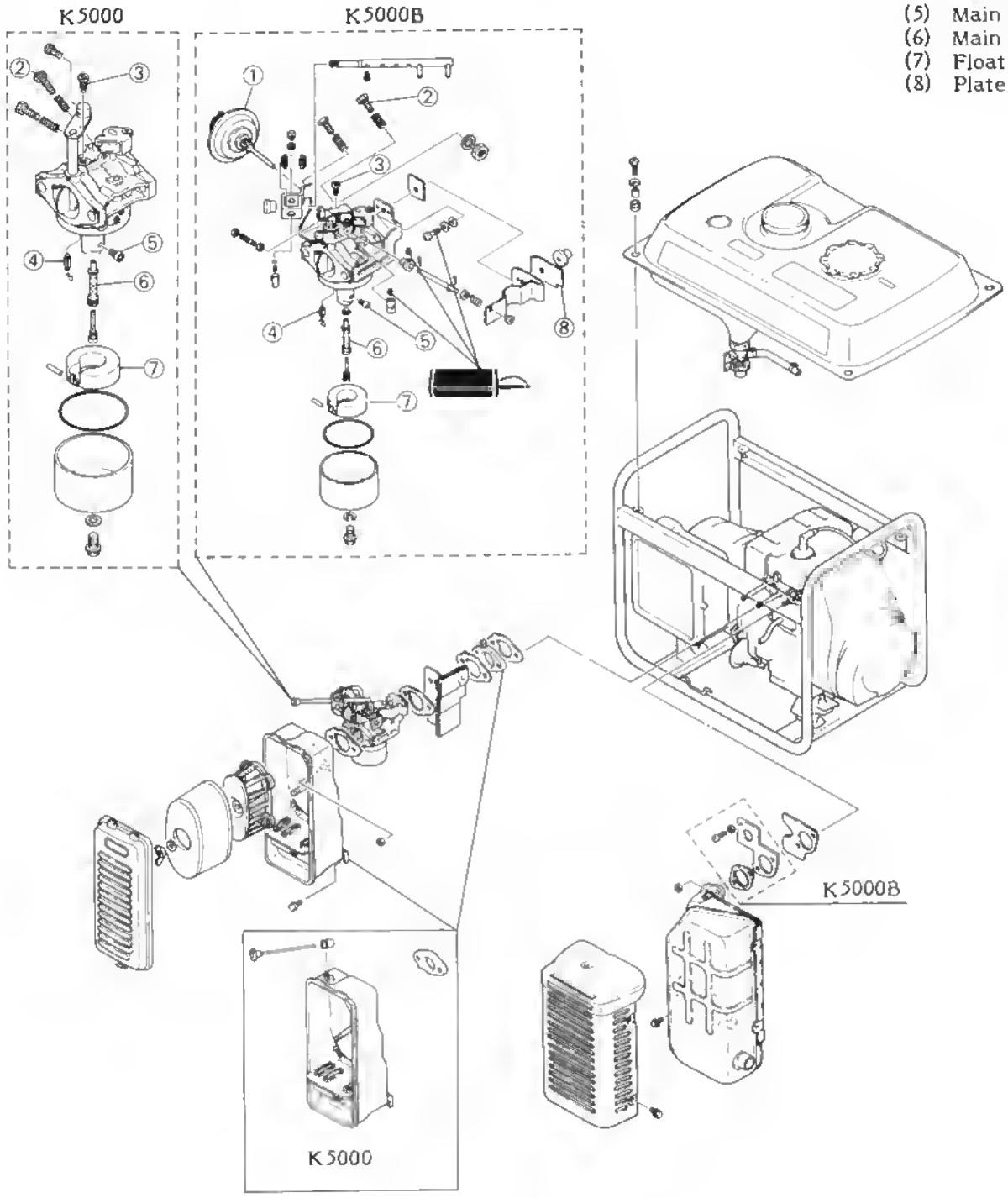
Exhaust joint setting (for "B" model)
After installing the air cleaner and muffler, turn the bolt to adjust the clearance between the plate 1 and exhaust joint 1 to 0.05 mm (0.002 in.) or less. Next, screw in the bolt 3/4 turn and tighten the locknut.

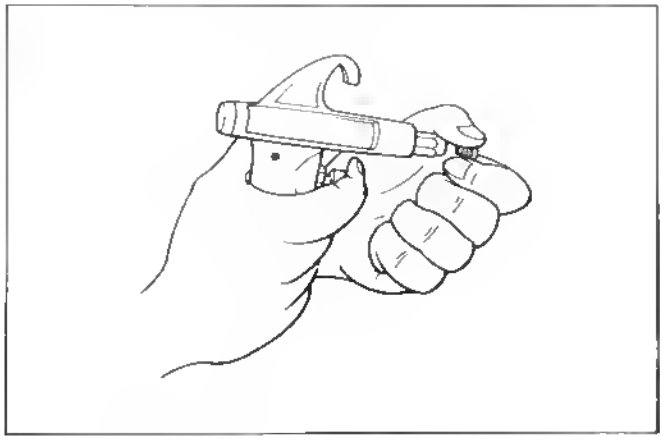
NOTE:
Exhaust joint 1 must be in a full-faced contact with the plate 1; otherwise, the auto-choke system will not operate satisfactorily.

4. DISASSEMBLY AND ASSEMBLY

4-1. FUEL TANK, AIR CLEANER, CARBURETOR, MUFFLER

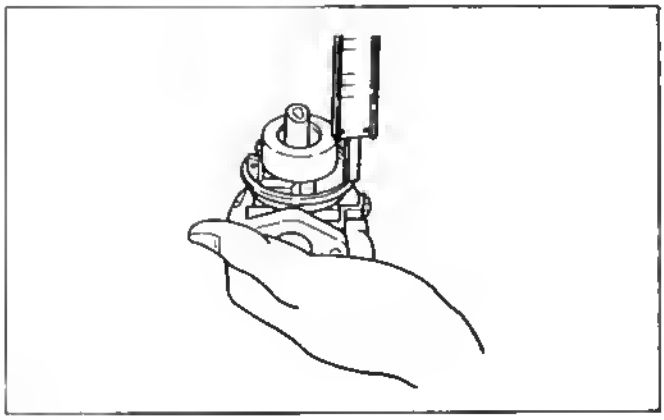
(1) Diaphragm
(2) Pilot screw
(3) Pilot jet
(4) Needle assy
(5) Main jet
(6) Main nozzle
(7) Float
(8) Plate 1





Carburetor assembly

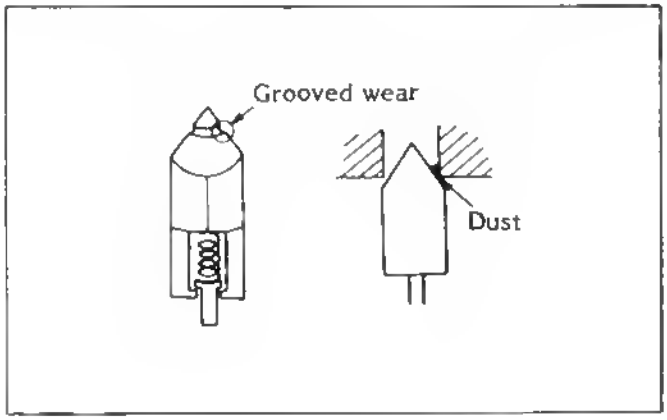
(1) Main jet and pilot jet
Check for clogging and clean with compressed air, if necessary.



(2) Measuring the float height
Place the carburetor in an inverted position for measurement.

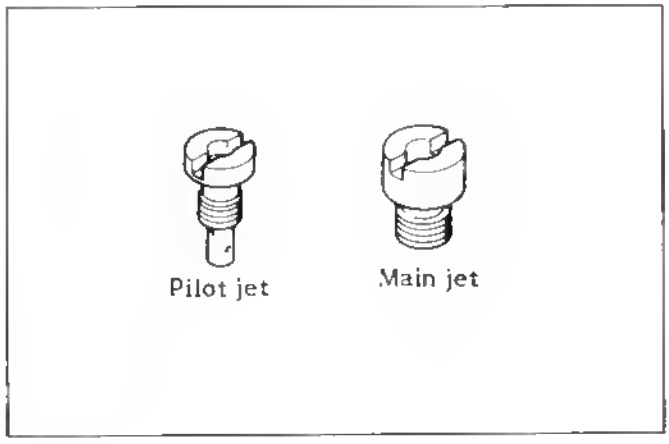
Measure the float height. (This measurement should be made with the gasket removed.)

Float height	13.0 ± 1.0 mm (0.51 ± 0.04in)

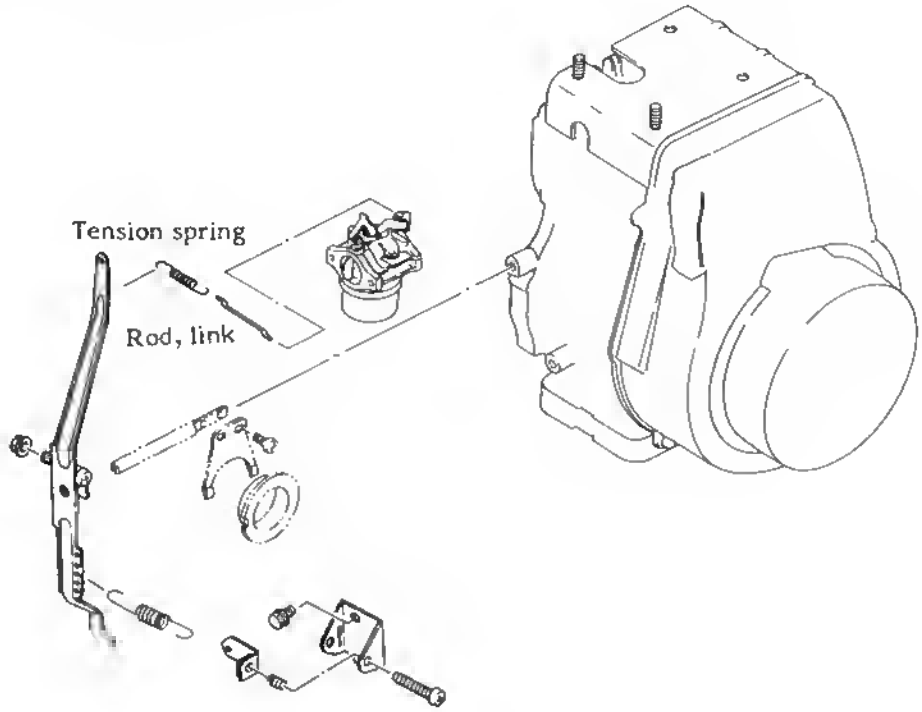


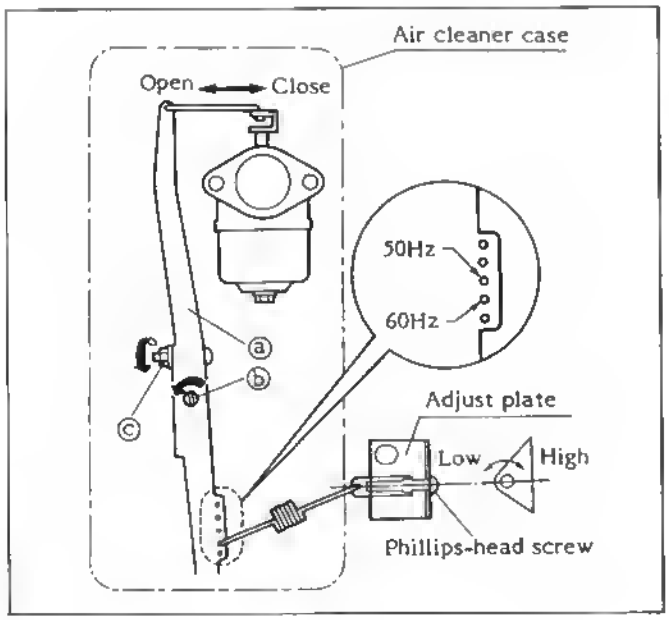
(3) Valve seat assembly
Check the valve and spring for scratches, grooves, wear, and fatigue. Replace them as required.
Check for dust or any other impurities between the valve and valve seat, and clean with compressed air, if necessary.

	K5000	K5000B
Main jet	#112.5	#112.5
Pilot jet	#65	#60
Pilot screw	1-1/4	1-1/2



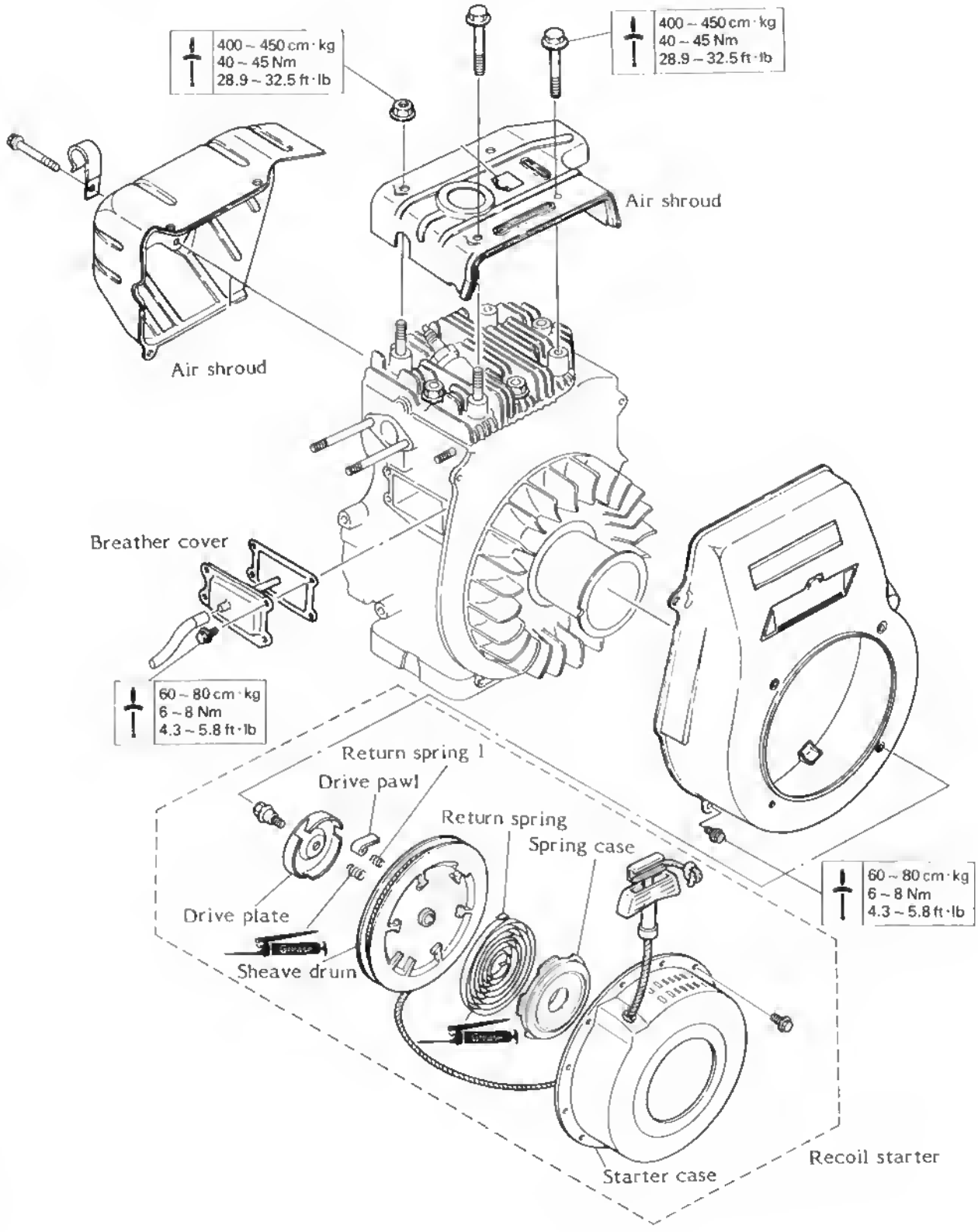
4-2. GOVERNOR ARM, THROTTLE LEVER

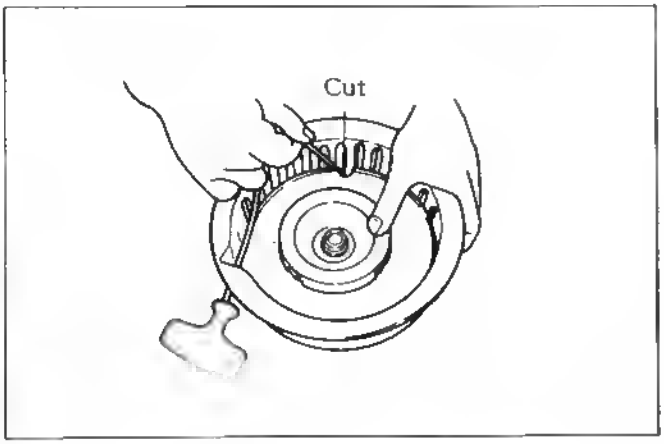




NOTE:
When disassembling or reassembling, be careful not to stretch the spring.

4-3. RECOIL STARTER, AIR SHROUD, BREATHER COVER

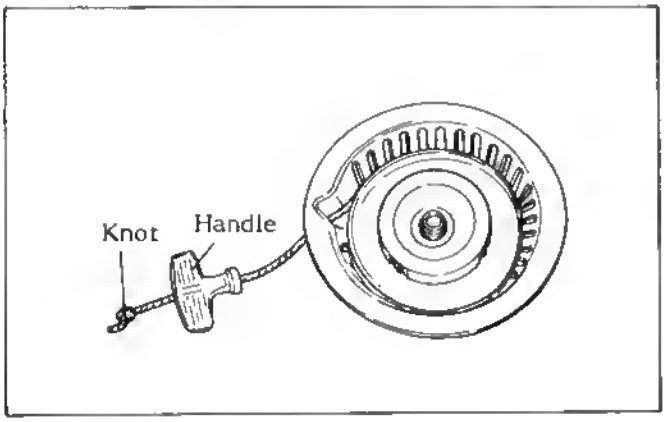




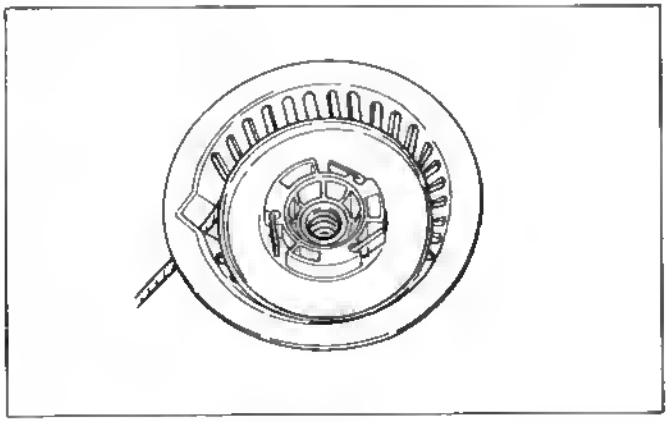
Recoil starter

(1) Disassembly

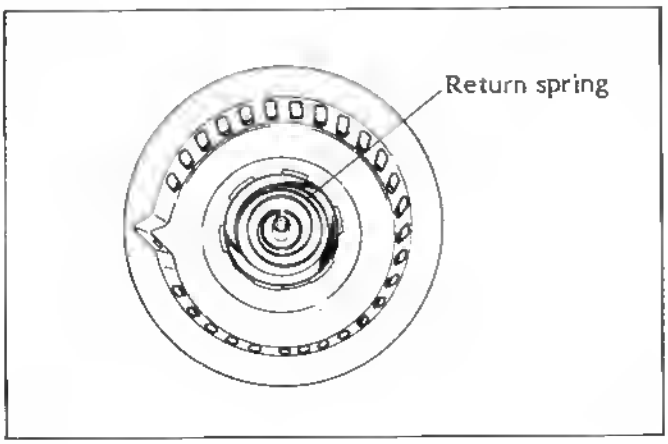
a. Hook the rope into the cut in the sheave drum, and turn the sheave clockwise so that spring tension is reduced.



b. Undo the knot in the rope, and remove the handle.

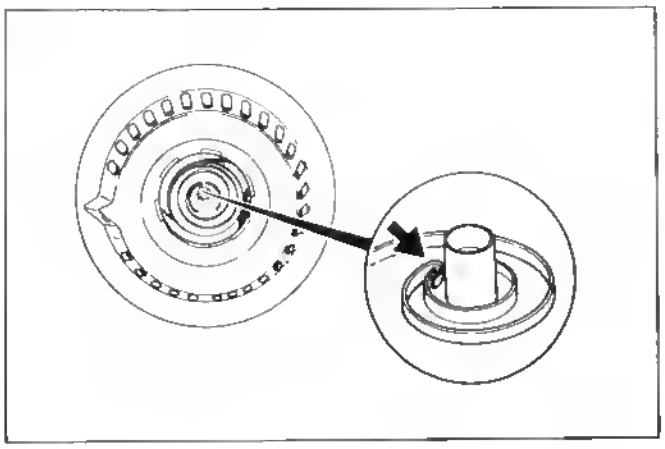


c. Remove the bolt on the sheave drum, and remove the drive plate and drive pawls.



d. Remove the sheave drum by lifting it upward.

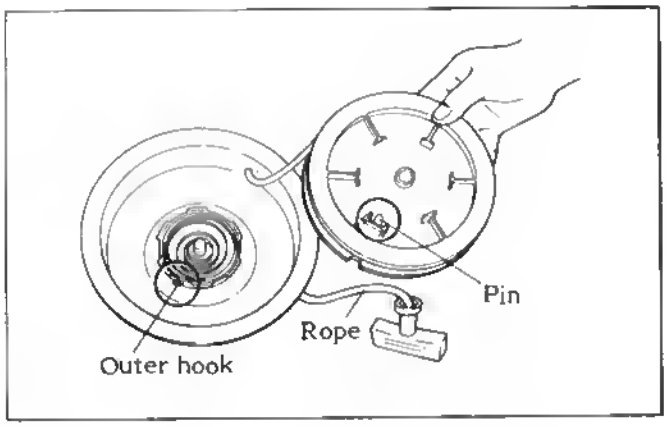
e. Remove the return spring with spring case.



(2) Assembly

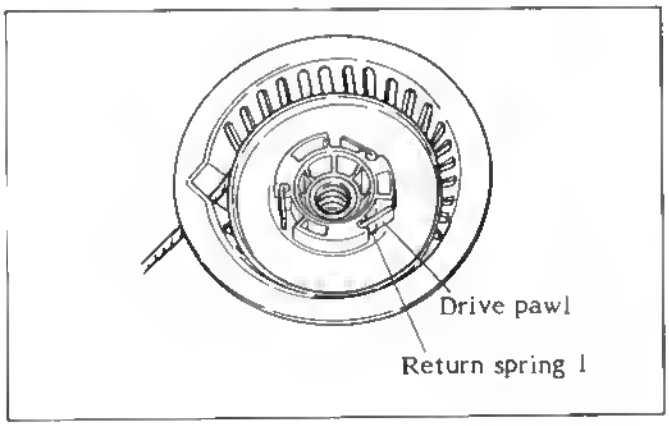
a. Install the return spring with spring case in the starter case.

NOTE:
Hook the return spring onto the spring hook on the starter case.



b. Wind the rope about two turns around the sheave drum, and install the sheave in the case, then attach the handle to the rope.

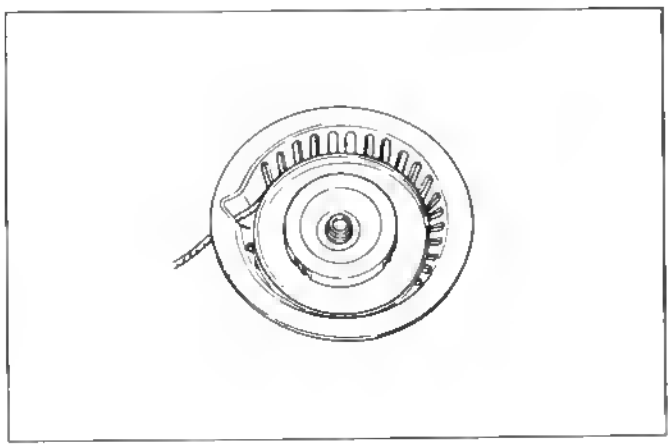
NOTE:
Be sure to align the outer hook of return spring with the pin on the sheave drum.



c. Rotate the sheave drum counterclockwise and check to see if spring force turns it clockwise.

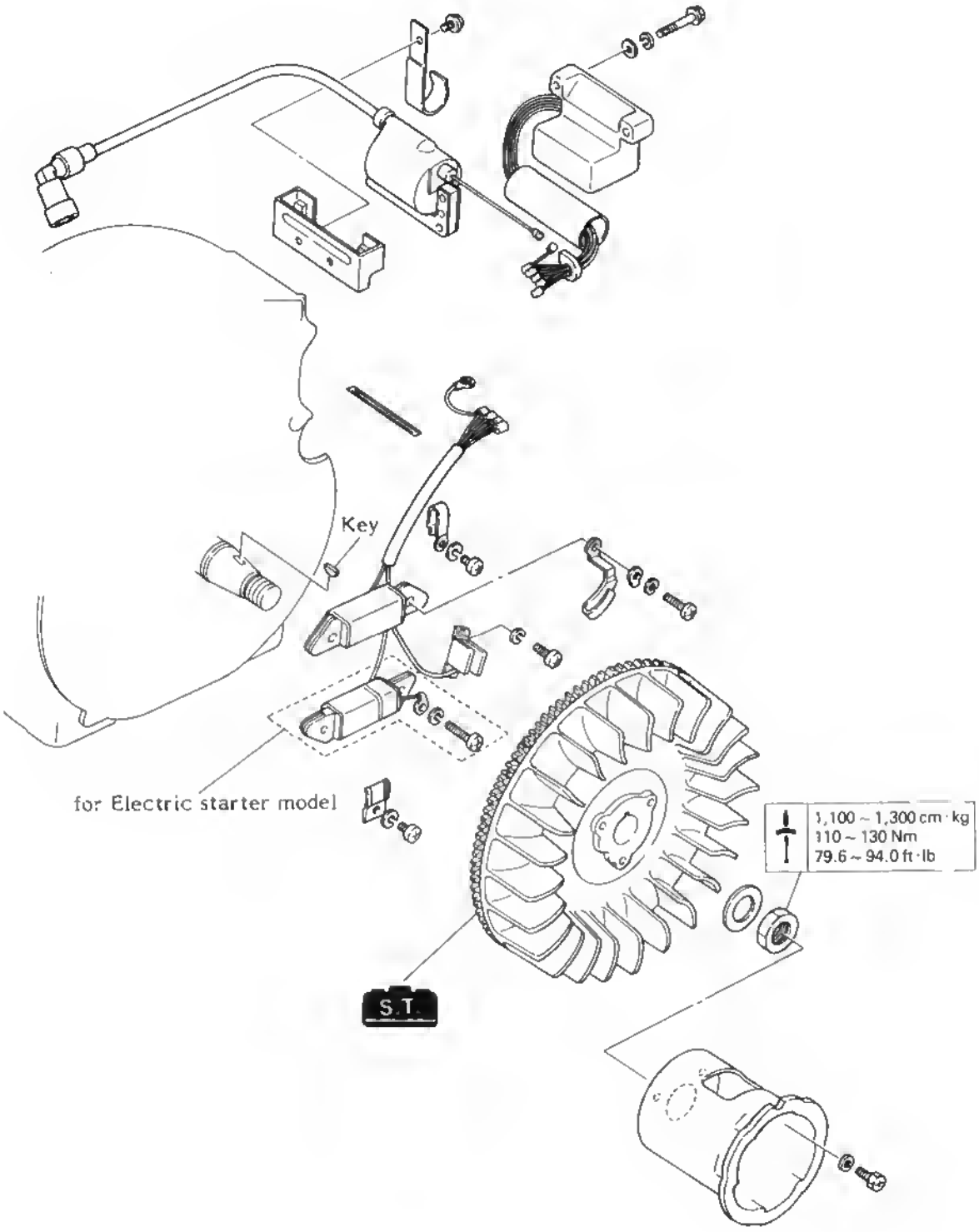
d. Install on the sheave drum the drive pawl(s) with return spring 1 and then the drive plate spring.

NOTE:
Make sure the drive pawl faces in the correct direction and it is positioned on the inner side of the return spring 1.

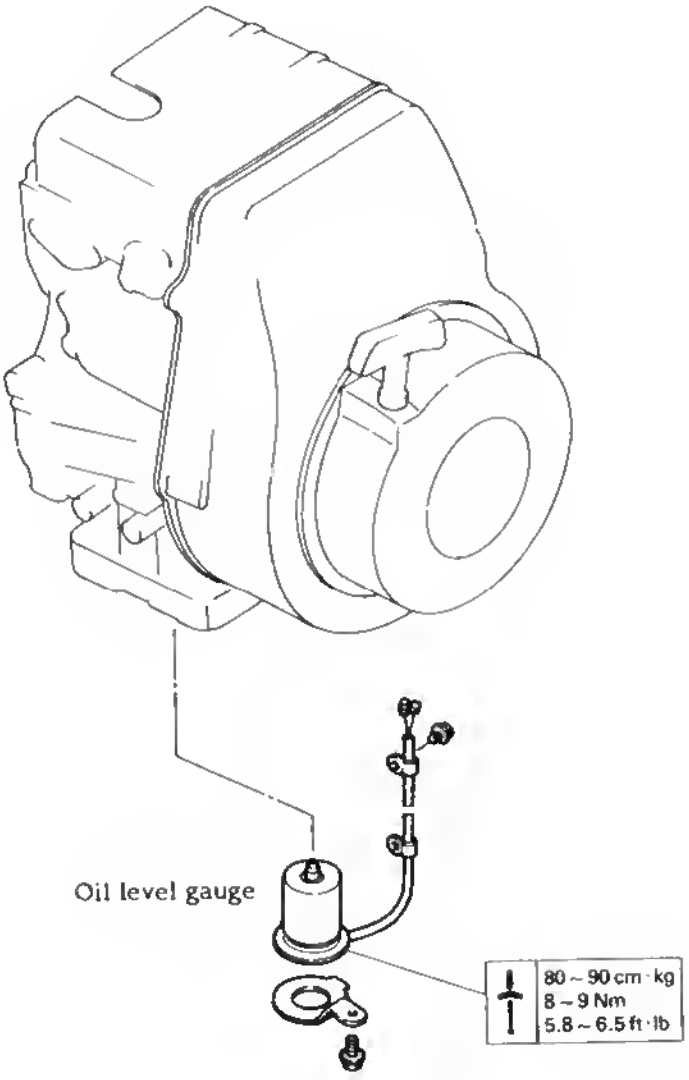


e. Install the drive plate. When installing the drive plate, make sure of the direction in which the ratchets move out.

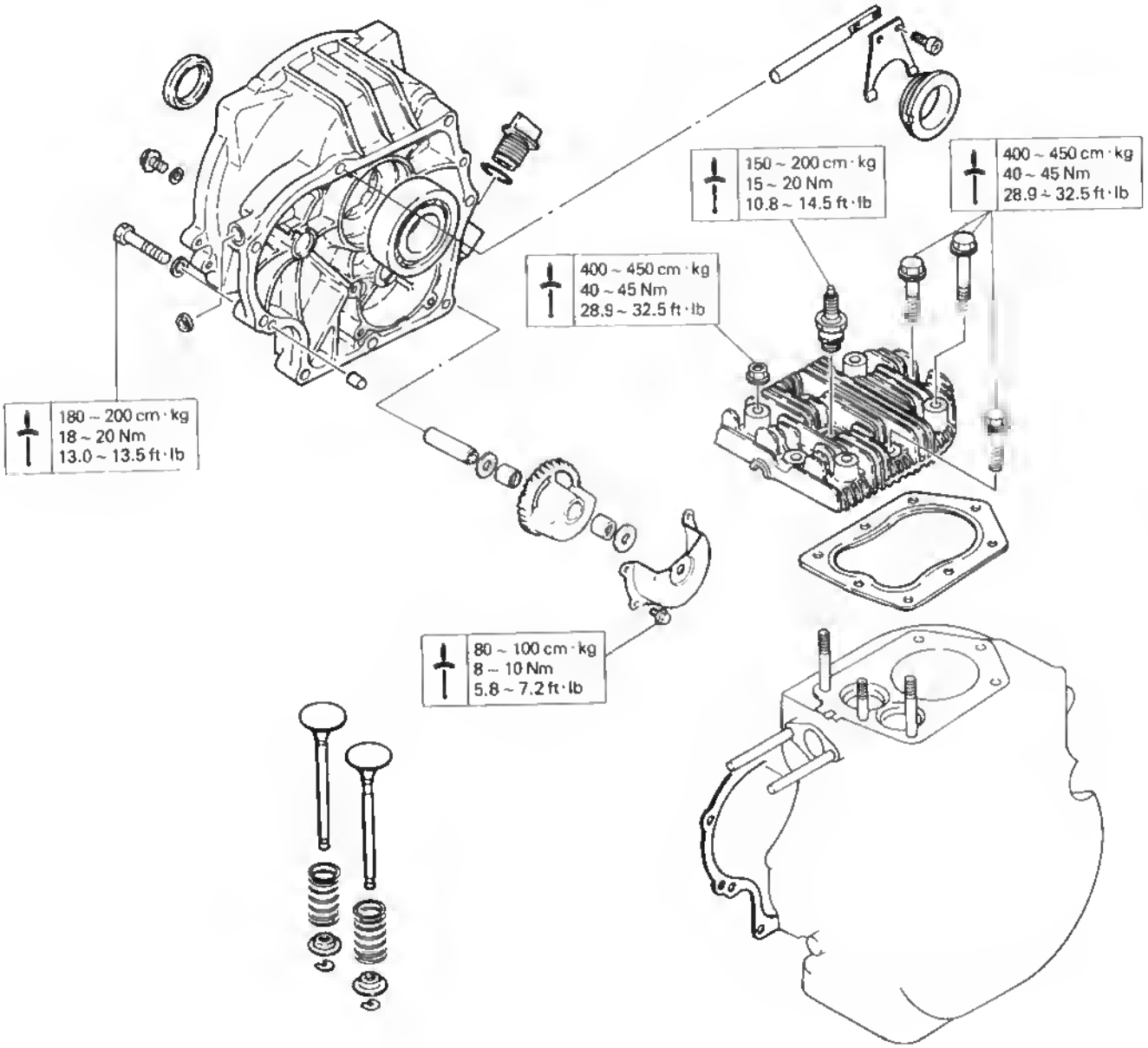
4-4. FLYWHEEL MAGNETO, IGNITION COIL

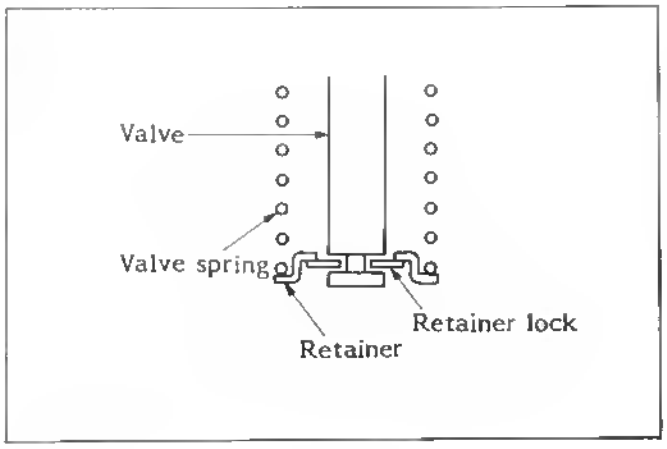


4-5. OIL LEVEL GAUGE



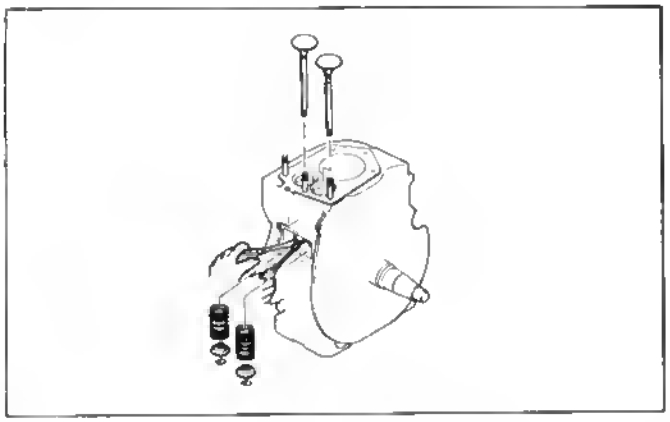
4-6. CYLINDER HEAD, CRANKCASE COVER, VALVE

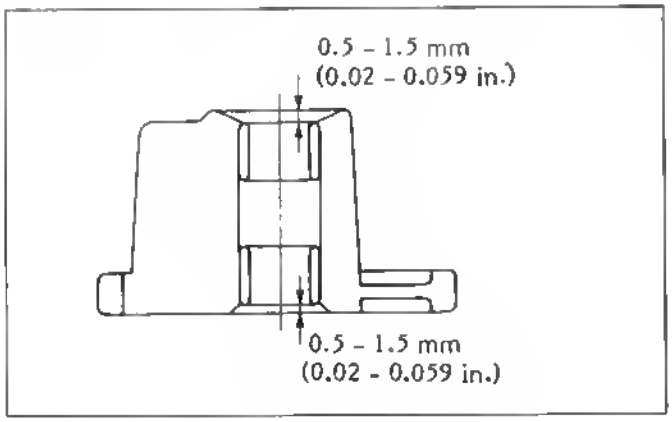




Disassembly of the valve and valve spring
Using two slotted-head screwdrivers, lift up the valve spring retainer and remove the retainer lock. Now the valve can be disassembled.

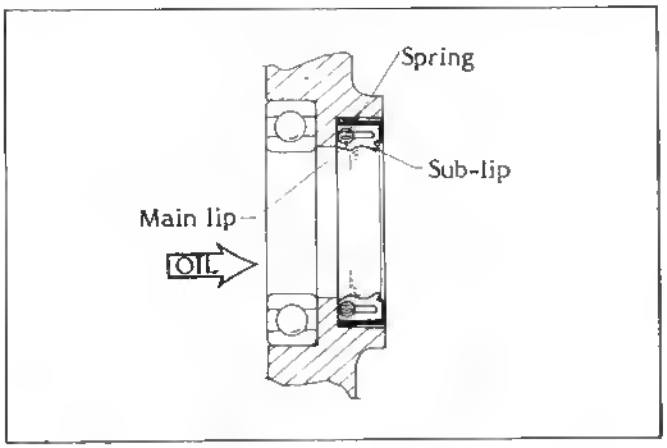
NOTE:
When lifting up the retainer with screwdrivers, be careful not to scratch the valve stem with the retainer.





Balancer bearing installation
Fit the bearings into the balancer gear. (See figure.)

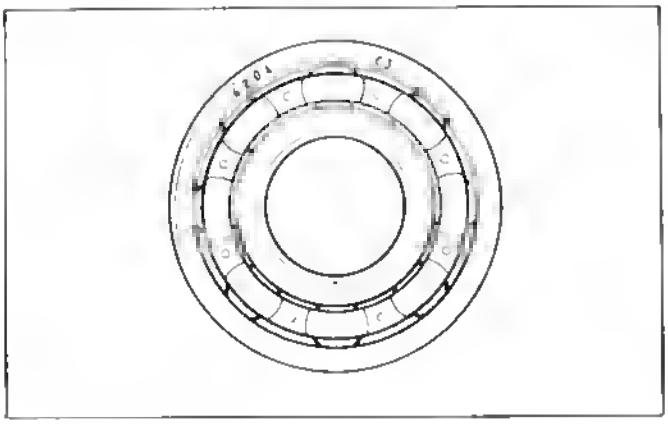
Depressed distance:
0.5 - 1.5 mm (0.02 - 0.059 in.)



Oil seal

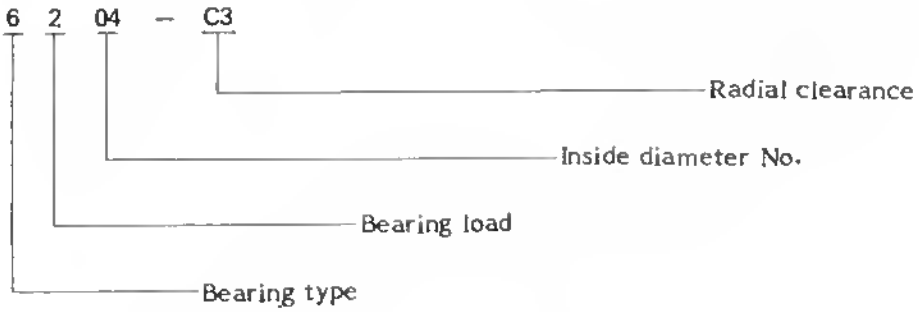
⚠CAUTION

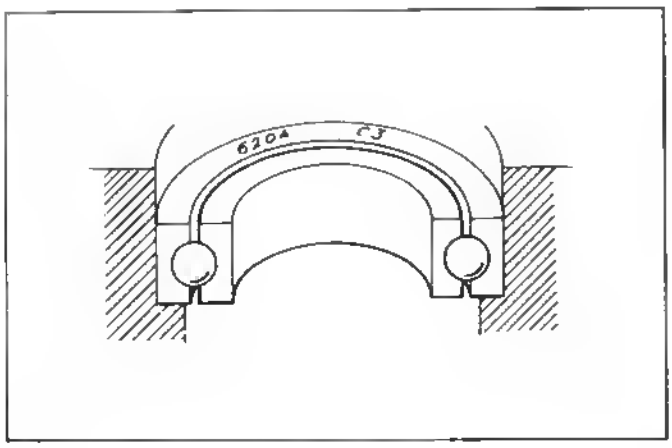
1. Be sure the main lip is on the oil chamber side. (So oil can be sealed in.)
2. Take care so that the lip is not damaged. When installing the oil seal, apply a liberal amount of grease to the lip.



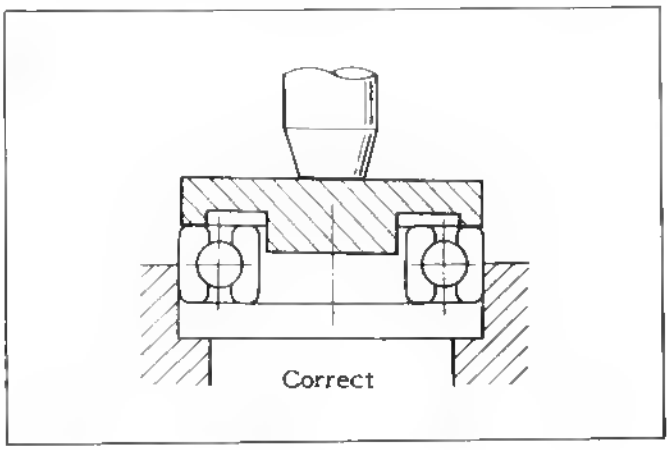
Bearing

(1) Designation number and symbol



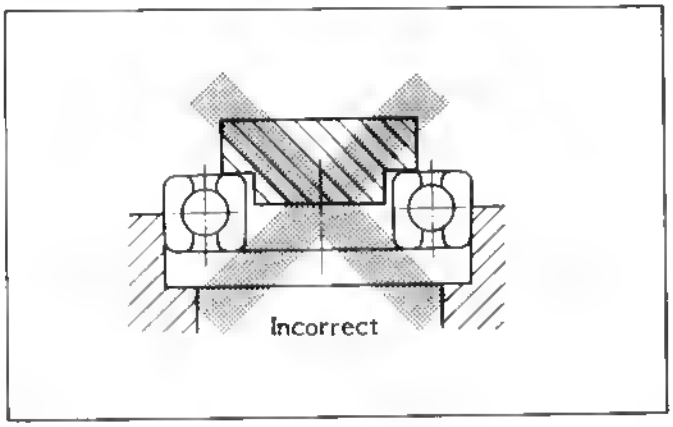


(2) Installation
The bearing should be driven in little by little.

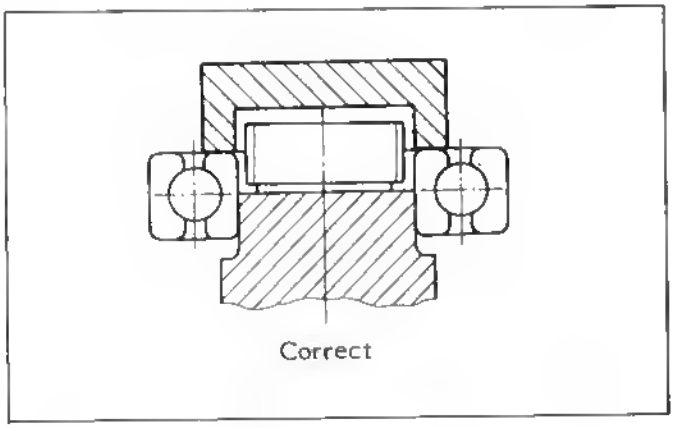


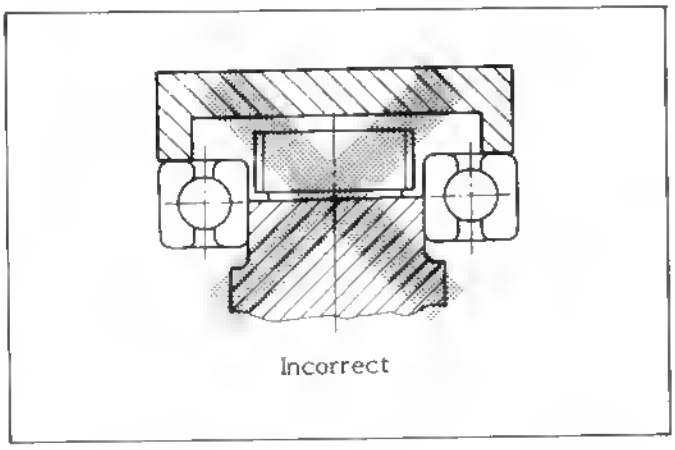
NOTE:
The bearing should be inserted with the markings on it face outward.

- When fitting the bearing in the case, strike the outer race.

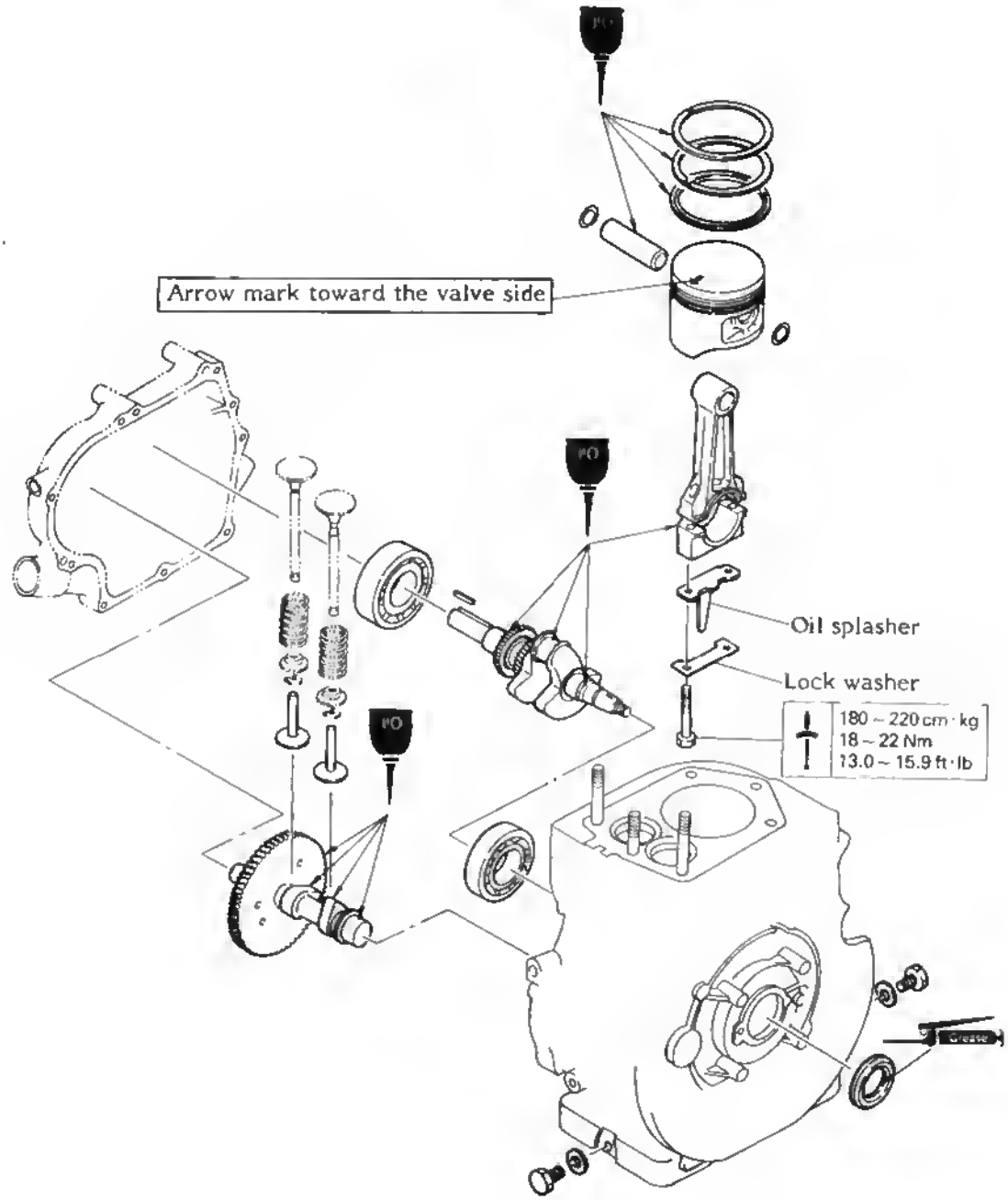


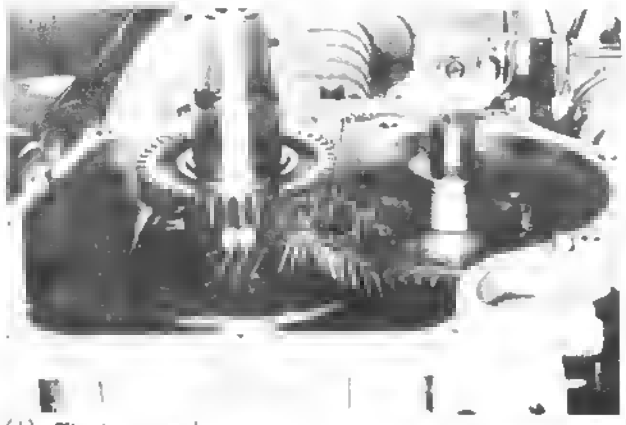
When installing the bearing over the shaft, strike the inner race.



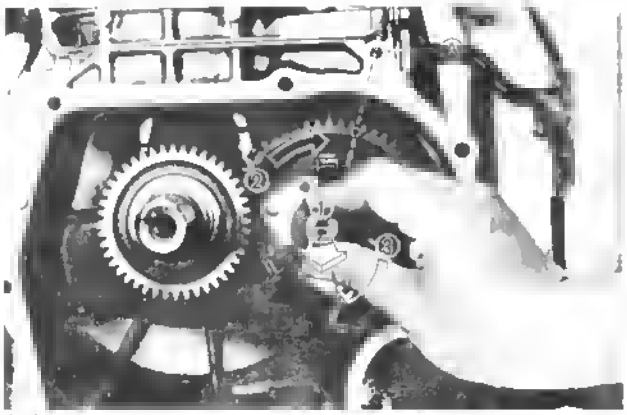


4-7. CRANKSHAFT, CAMSHAFT, CONNECTING ROD, PISTON

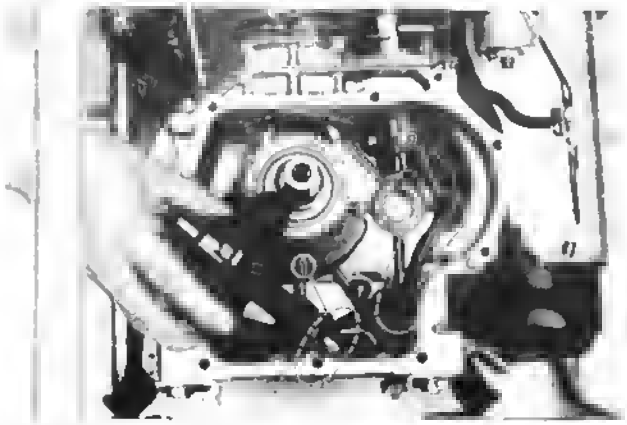




(1) Timing mark



(A) Tapped hole



(1) Flat end side
(2) Crankcase wall

Camshaft

(1) GS410(B)-DG-ONAN

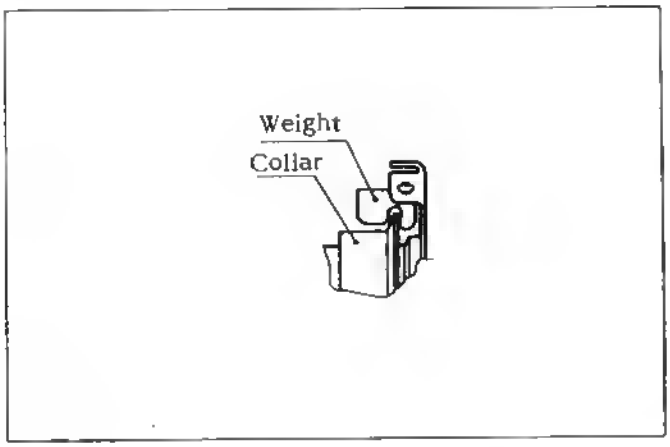
a. Removal

Align the timing marks on the camshaft and crankshaft. Next, pull the camshaft upward and align the timing mark with the tapped hole in the crankcase by turning the camshaft clockwise. Then, remove the camshaft by sliding it along the crankcase wall.

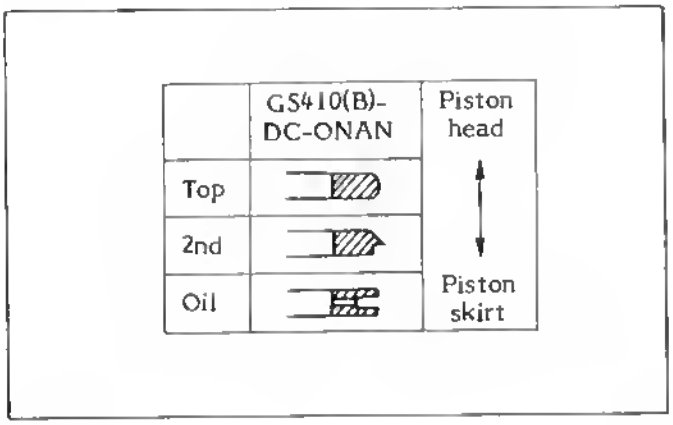
NOTE:
When removing the valve lifters, mark the valve lifters so that the exhaust and intake valve sides are not confused.

b. Installation

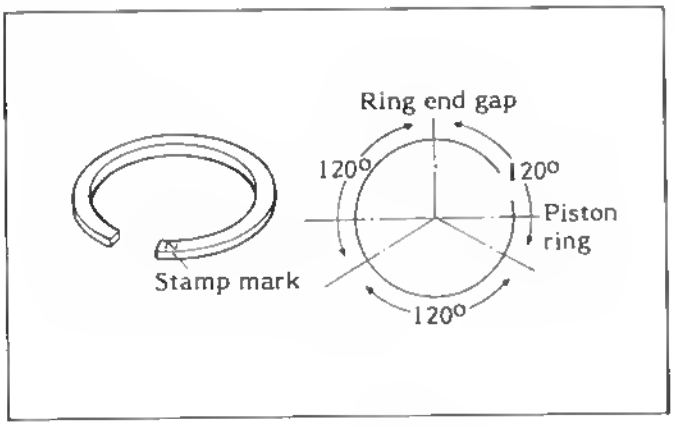
Set the crankshaft at top dead center (TDC). Next, insert the flat end side of the camshaft into the crankcase by sliding it along the crankcase wall, and align the timing marks on the camshaft and crankshaft.



(2) Governor collar installation
Install the governor collar so that it contacts the weights as illustrated.

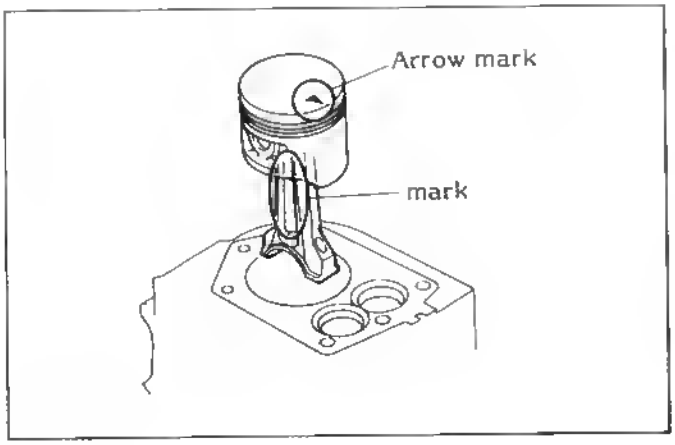


Piston ring installation
The piston ring set consists of the top, 2nd and oil rings, and they differ in shape as shown to the left.



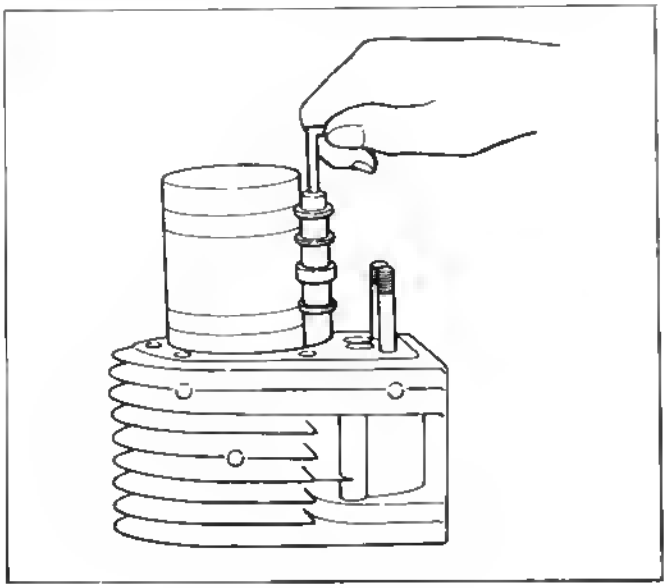
NOTE:
The ring should be installed with the mark facing upward.

The piston rings should be so installed that the end gaps do not line up with the piston boss and are 120° off each other. The sequence of installation is the oil ring, 2nd ring and top ring.

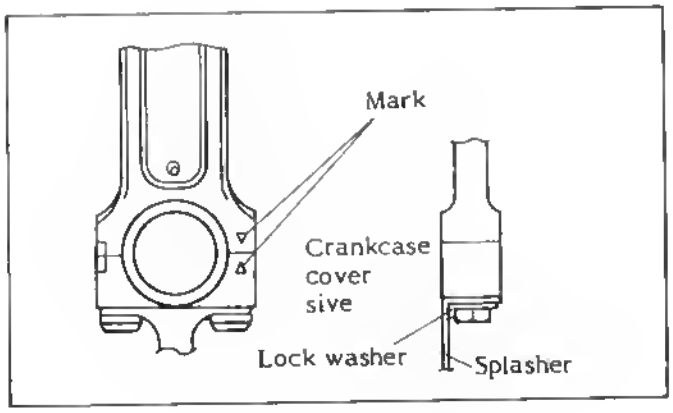


Piston installation
(1) Install the piston on the connecting rod so that the mark on the connecting rod is on the crankcase cover side and that the arrow mark (►) on the piston crown is on the valve side.

NOTE:
Replace any deformed piston pin clip.



(2) Using a piston ring compressor (special tool), hold down the ring and top on the piston crown and tap into cylinder with a wooded hammer handle.



Connecting rod installation

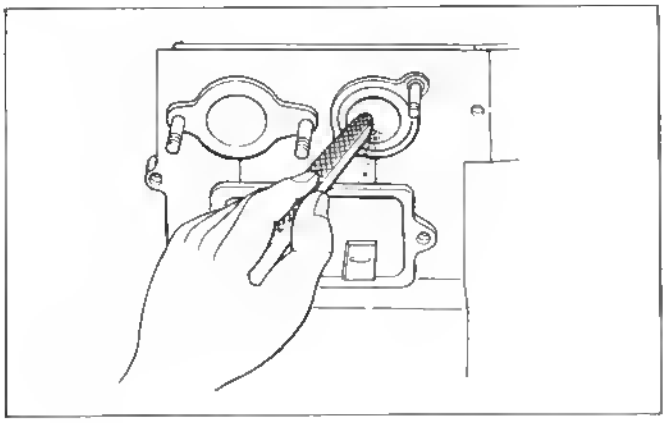
Align the marks on the connecting rod and cap, tighten the bolt and bend the lock washer over the bolt to lock.

⚠CAUTION

To ensure proper engine lubrication, the splasher should be installed as shown so that the bent portion is on the crankcase cover side.

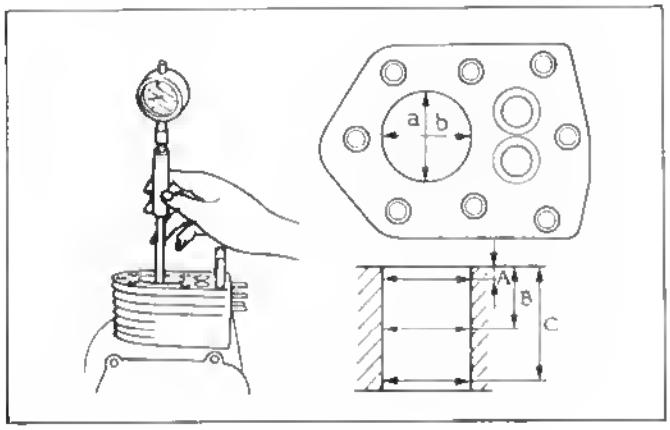
5. INSPECTION

5-1. ENGINE



Cylinder

(1) Cleaning exhaust port
When cleaning, take care not to scratch the inner wall of the port.



(2) Measuring wear on the cylinder wall
Using a cylinder gauge or inside micrometer, measure the amount of wear on the cylinder wall.
Measurements should be made at six places, that is, at three depths, A, B and C, and in the directions of a and b, as shown.

Wear Limit:

Max. difference between measurements at A, B and C should be 0.15 mm (0.006 in) or less.

mm (in)

A	10 (0.39)
B	60 (2.36)
C	120 (4.72)

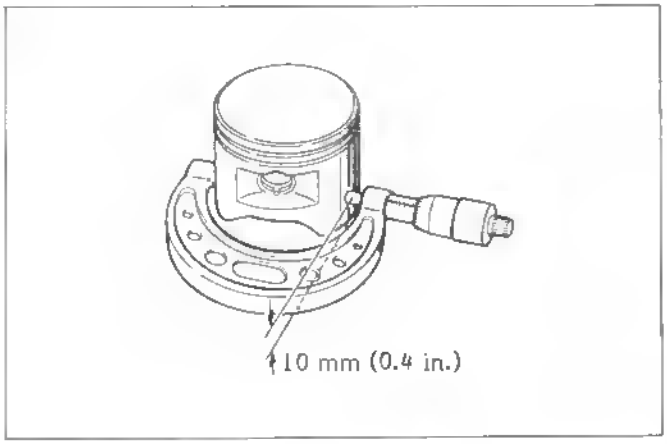
(3) Cylinder size

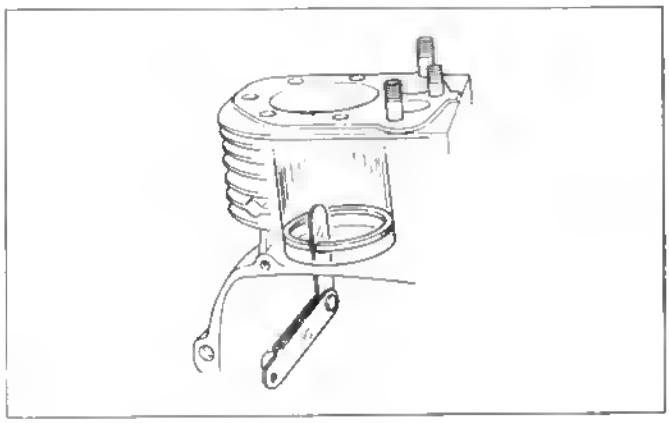
mm (in)

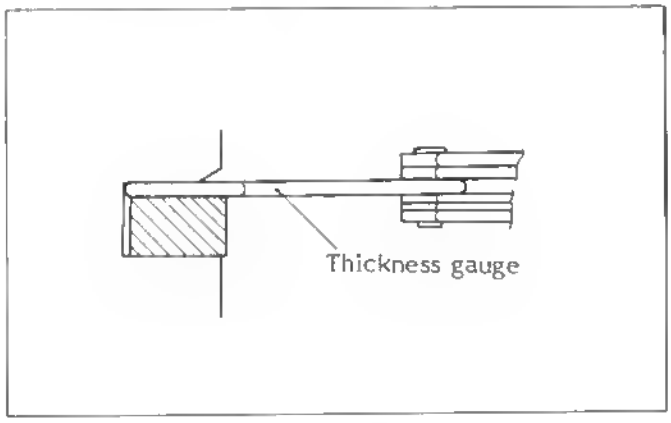
	STD	Limit
Cylinder size	86.00 (3.386)	86.15 (3.392)

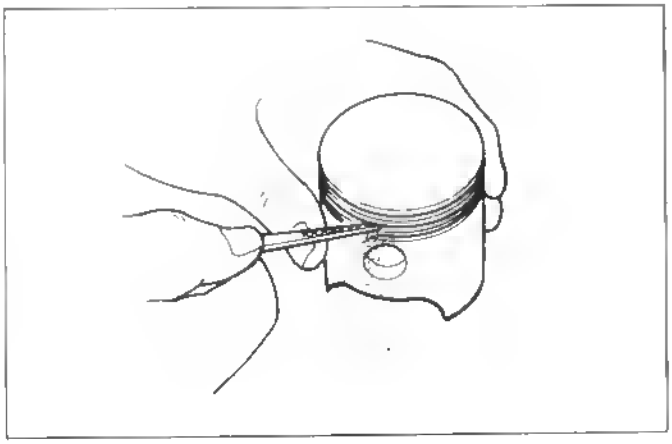
	STD	Limit
Piston clearance:	0.065 - 0.075 mm (0.0026 - 0.030 in)	0.15 mm (0.006 in)

5. INSPECTION









Piston size

mm (in)

STD	Limit
86.0 (3.386)	85.9 (3.382)

OVER size piston

mm (in)

1	86.25 (3.396)
2	86.50 (3.406)

Piston ring

(1) Ring end gap
Put a piston ring into the cylinder wall from its bottom, by pushing it with the piston head, and measure the end gap.

NOTE:
The piston ring end should be measured with the ring placed in the lower part (where minimum wear occurs) of the cylinder. (The same applies to all of the top, second and oil rings.

mm (in)

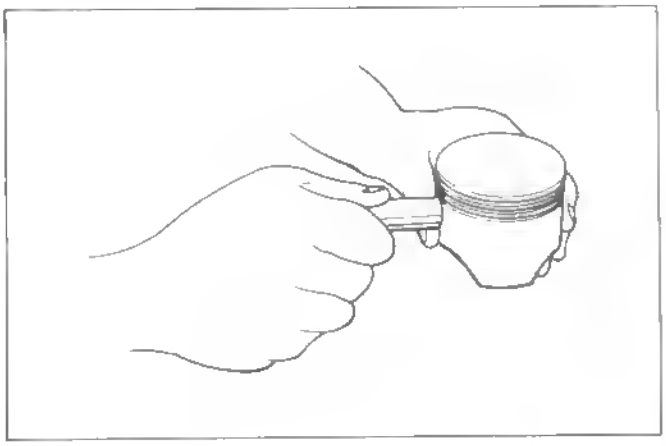
	STD	Limit
Top	0.1 - 0.2 (0.0039 - 0.0079)	0.5 (0.0197)
2nd	0.1 - 0.25 (0.0039 - 0.0098)	
Oil		

(2) Ring groove side clearance
Fully insert the thickness gauge into the ring groove and measure the side clearance at several places.

NOTE:
If a ring is stuck, remove it and clean the groove, then measure the side clearance. (Take care not to scratch the piston when cleaning.)

mm (in)

	STD	Limit
Top	0.04 - 0.08 (0.0016 - 0.0031)	0.15 (0.0059)
2nd	0.02 - 0.06 (0.0008 - 0.0024)	
Oil		

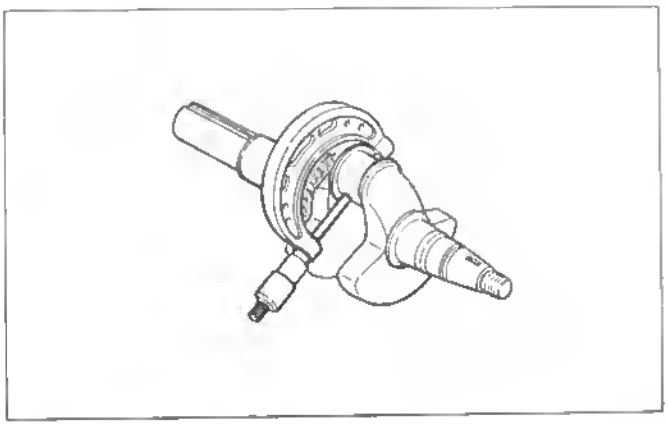


Piston pin

(1) Wear on piston pin
The piston pin should be thumb-fit.
If it is hard to fit in the pin hole, check for obstacles on the inner surface of the hole, and remove them using a knife or scraper, as required.

mm (in)

STD	Limit
20.0 (0.787)	19.95 (0.785)

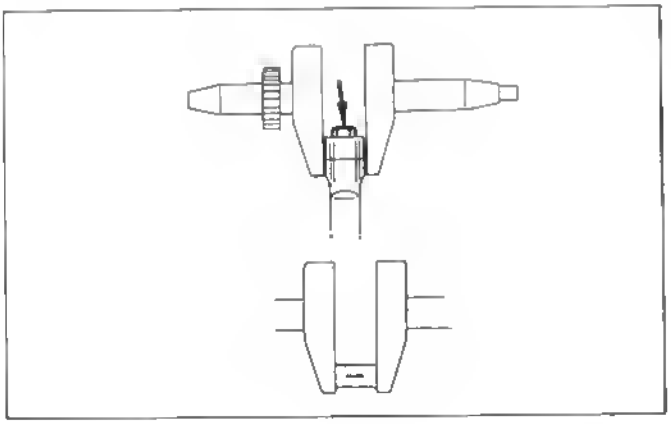


Crankshaft

(1) Wear on crank pin
(2) Crank pin diameter

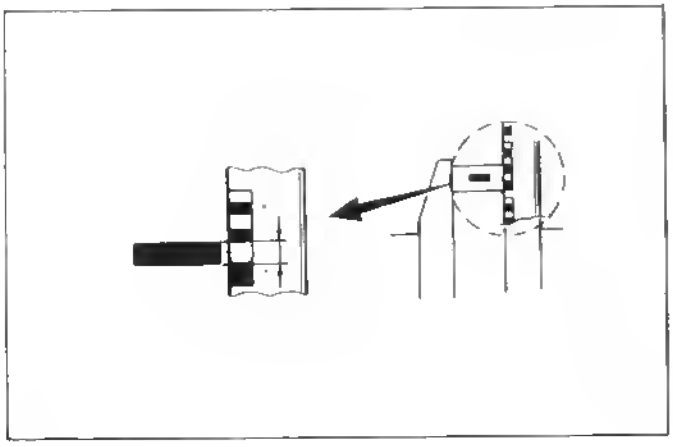
mm (in)

STD	Limit
37.0 (1.457)	36.9 (1.453)

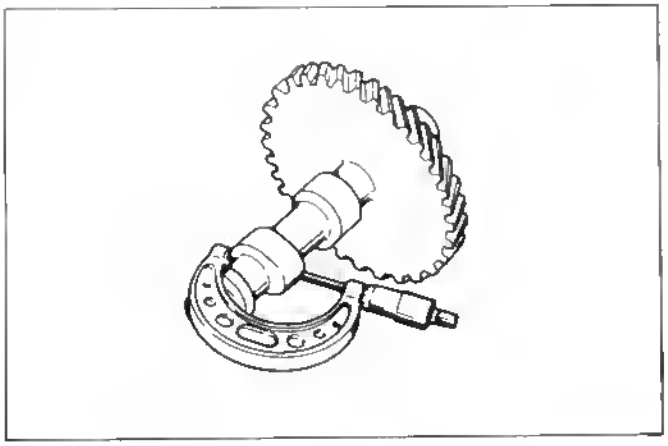


(3) Measuring the oil clearance
Using a plastigage, measure the oil clearance.

Standard oil clearance:
0.016 - 0.034 mm
(0.00063 - 0.0013 in)



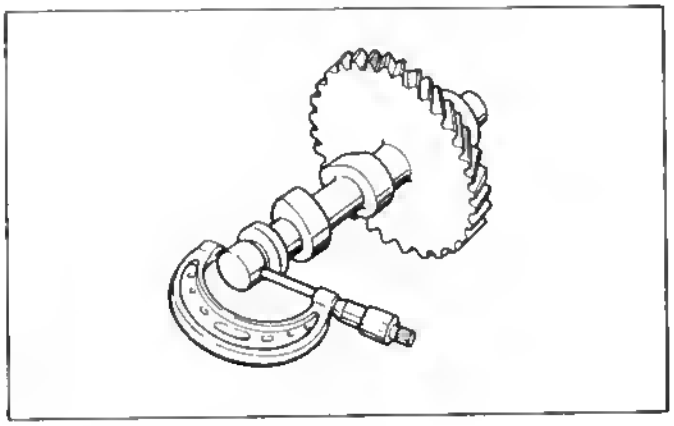
NOTE:
Tightening torque: 18 - 22 Nm
13.5 - 15.9 ft·lb
180 - 220 cm·kg



Camshaft
(1) Camshaft cam height

mm (in)

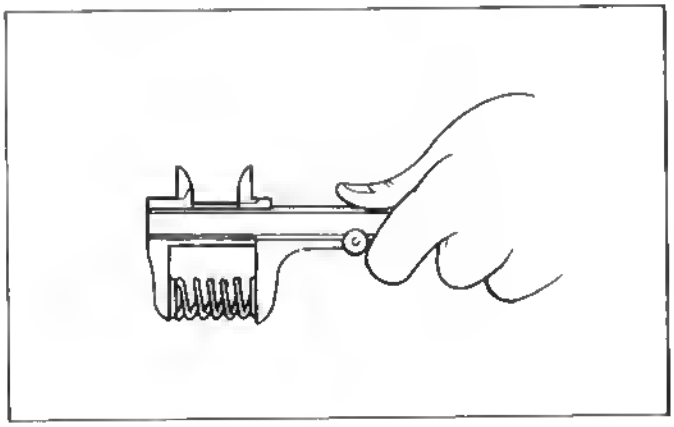
STD	Limit
38.0 (1.496)	37.75 (1.486)



(2) Camshaft outside diameter

mm (in)

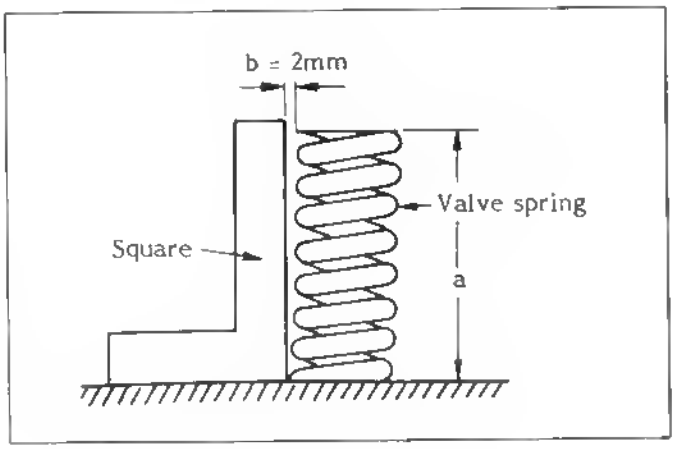
STD	Limit
25.0 (0.984)	24.90 (0.980)



Valve
(1) Valve spring
Measure the free length of the valve spring using vernier calipers.

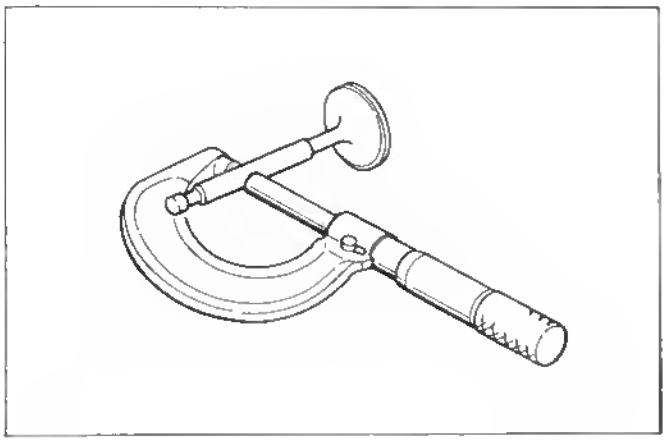
mm (in)

	STD	Limit
Free length	41.0 (1.614)	39.0 (1.535)



Using a square, check the squareness of the valve spring.
Replace the valve spring, if it is bent.

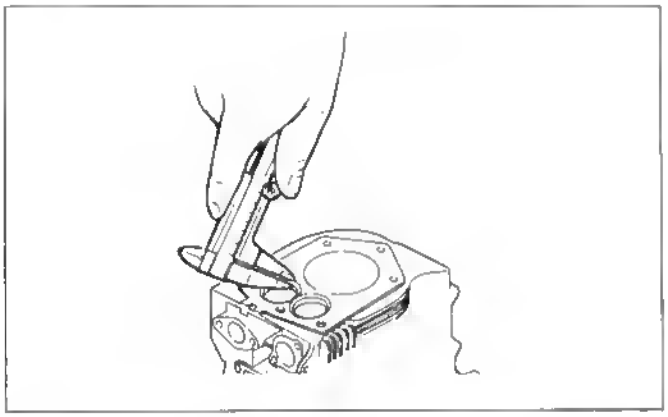
Squareness: Within 2 mm (0.079 in)



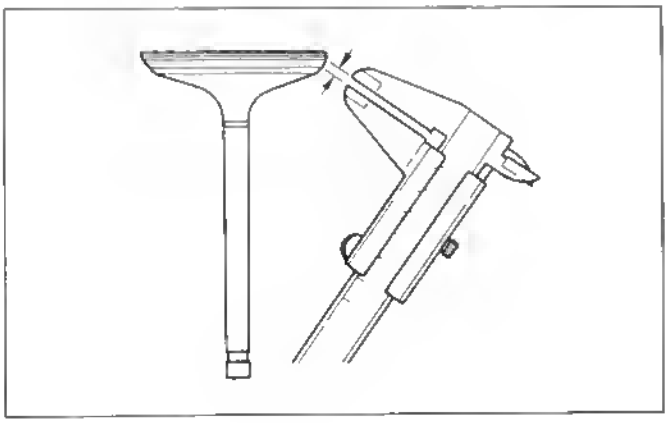
(2) Valve stem

mm (in)

	STD	Limit
EX	7.0 (0.276)	(6.75 (0.266)
IN	7.0 (0.276)	6.8 (0.268)

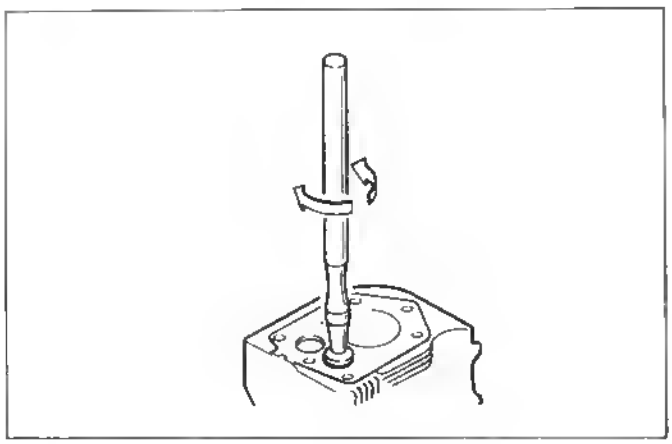


(3) Valve seat
If valve seating or sealing is poor, the valve must be lapped against the valve seat. If the contact width of the valve with the seat is too large, replace the valve with a new one.



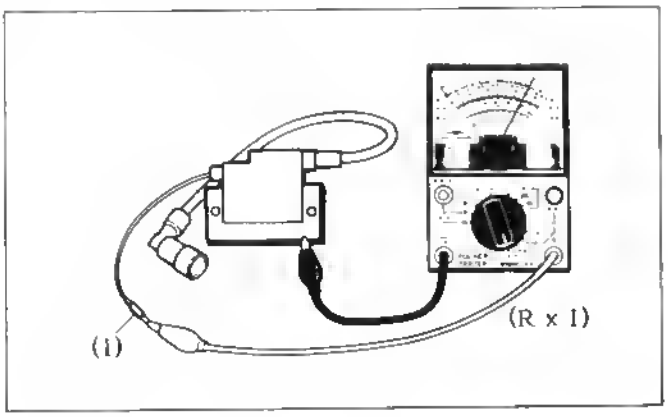
mm (in)

	STD	Limit
Valve contact width	0.7 - 0.9 (0.028 - 0.035)	2.0 (0.079)



(4) Valve lapping
a. Apply a coarse grain compound to the valve face evenly, place it in the valve seat and rotate it to the right and left, using a valve lapping tool.
b. Next, coat the valve face with a fine grain compound, and lap it against the seat.
c. Thoroughly clean both valve face and seat, and apply red lead to the valve face, then check valve seating and sealing.

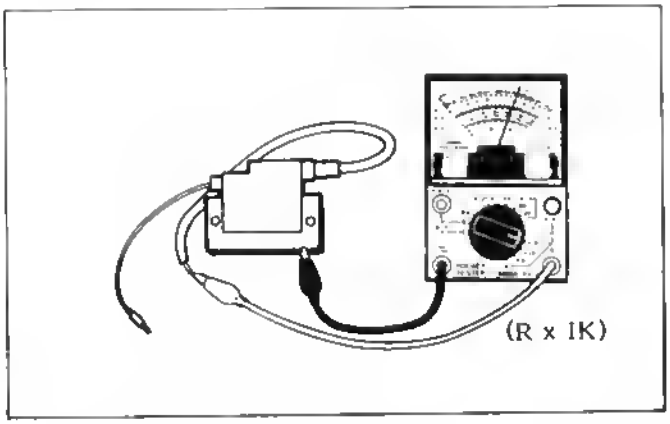
5-2. ELECTRICAL



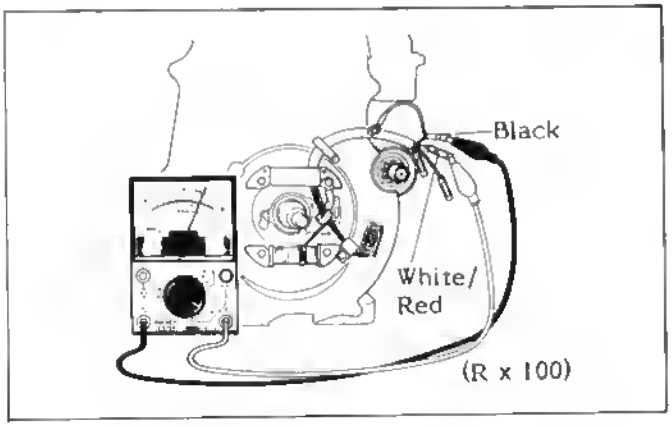
Ignition coil

o Checking procedure
a. Primary winding .... Connected to body and (1)
b. Secondary winding . Connected to body and high-tension wire

Primary winding resistance:	0.76Ω ±10%
Secondary winding resistance:	10KΩ± 20%

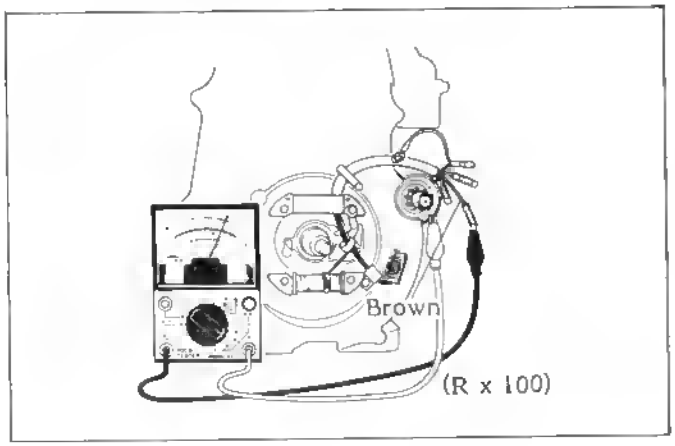


NOTE:
While you can test an ignition coil using the Pocket Tester, it is advisable to use the Coil Tester for better results.



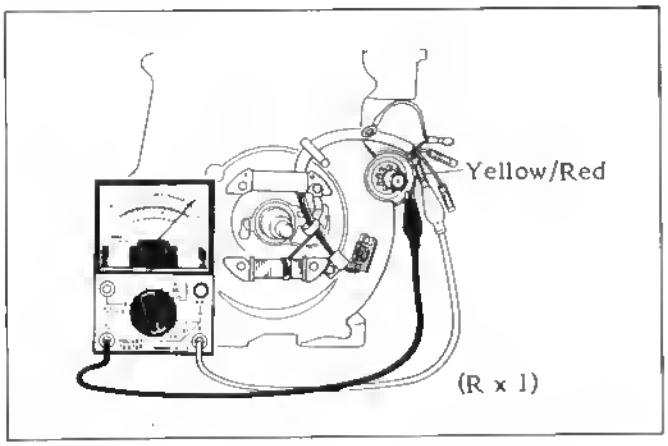
Pulser coil

Pulser coil resistance:	197Ω±10% (at 20°C)



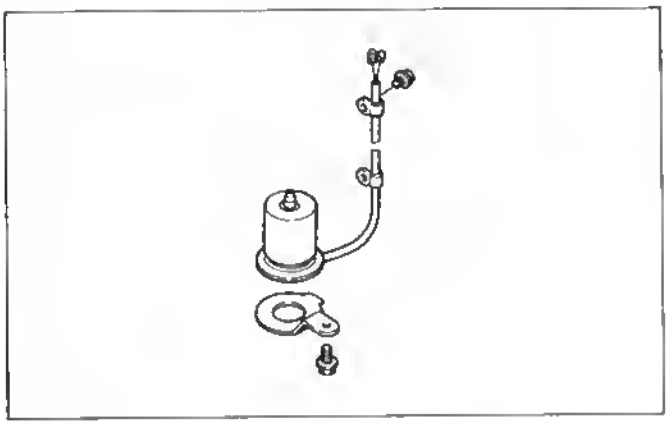
Charge coil

Charge coil resistance:	315Ω±10% (at 20°C)



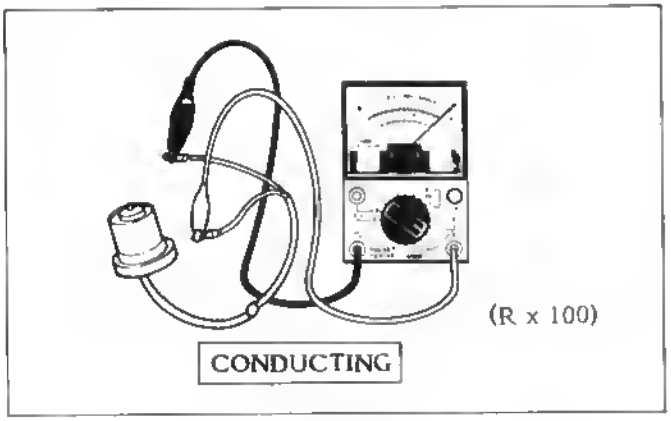
Battery charge coil
(for electric starter model)

Battery charge coil resistance:	0.77 Ω ±10%



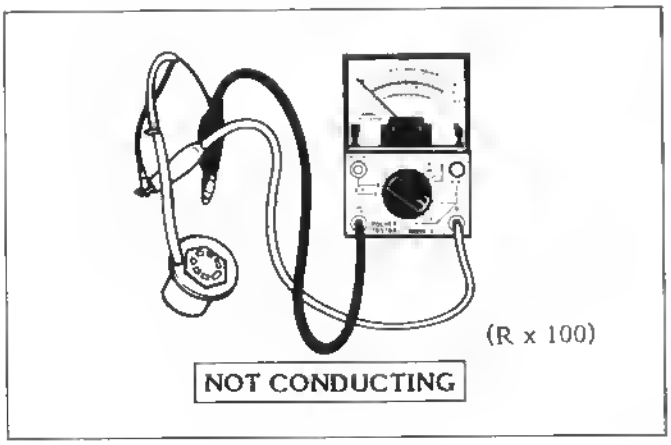
Oil level gauge

NOTE:
Tightening torque: 8 - 9 Nm
5.8 - 6.5 ft·lb
80 - 90 cm·kg



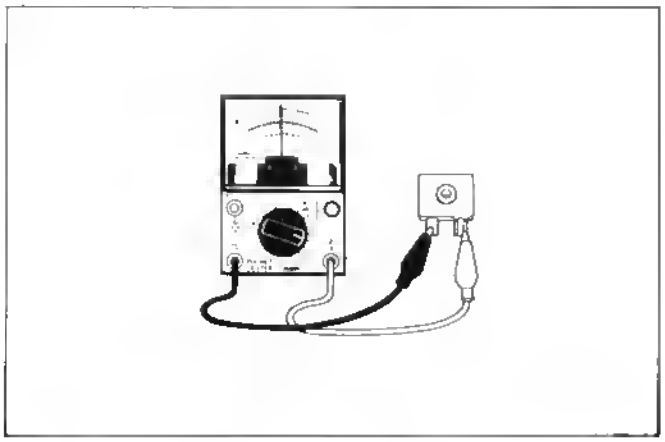
NORMAL:

NOTE:
With gauge pointing upward



NOTE:
With gauge pointing downward

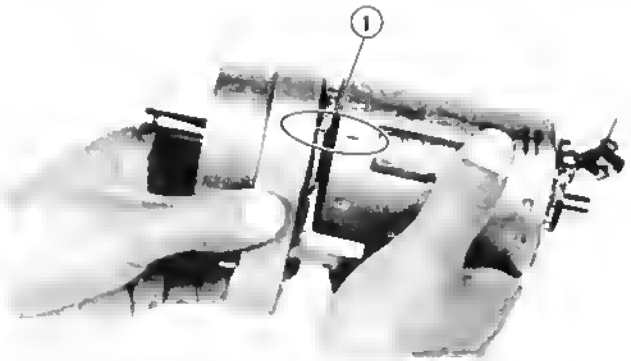
5. INSPECTION



Rectifier (for electric starter model)

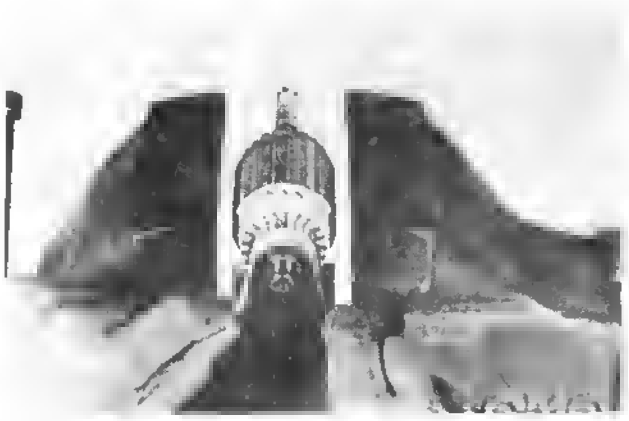
Normal direction	Conducting
Reverse direction	Not conducting

Starter motor (for electric starter model)



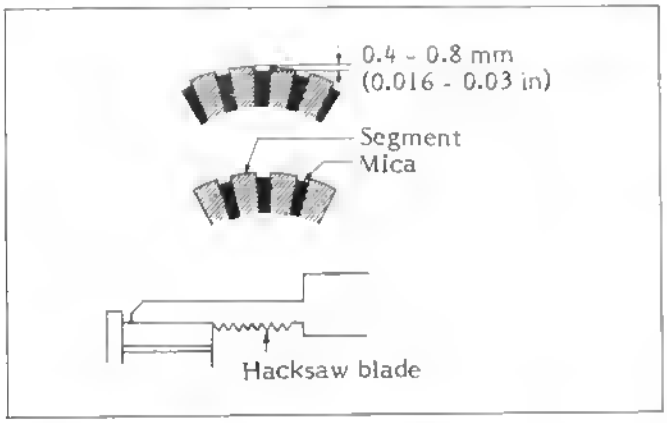
① Aligning mark

5. INSPECTION



Commutator

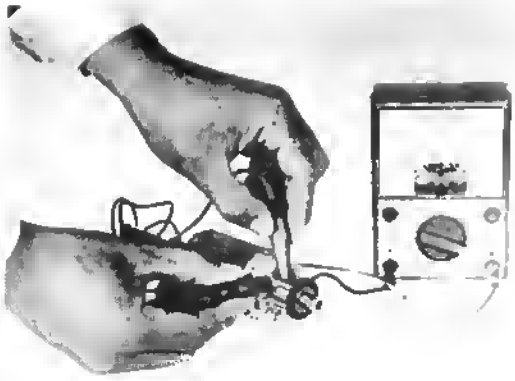
a. Check the outer surface of the commutator. If its surface is dirty, clean it with #600 grit sandpaper.



b. The mica insulation between the commutator segments should be 0.4 - 0.8 mm (0.016 - 0.031 in) below the segment level. If not, scrape the mica to proper limits with an appropriately shaped tool. (A hacksaw blade can be used to cut down mica.)

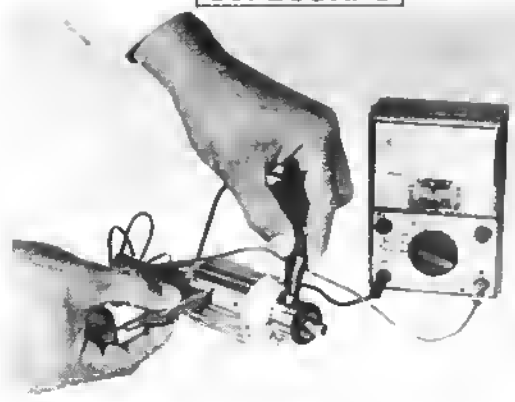
NOTE:
Undercut to ensure proper operation of commutator, if necessary.

Commutator dia limit:	27 mm (1.06 in)



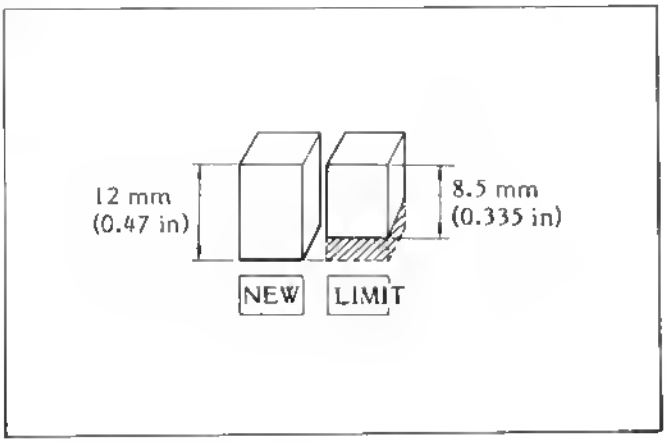
CONDUCTING (R x 100)

c. The armature coil should be checked for continuity. Use a pocket tester.



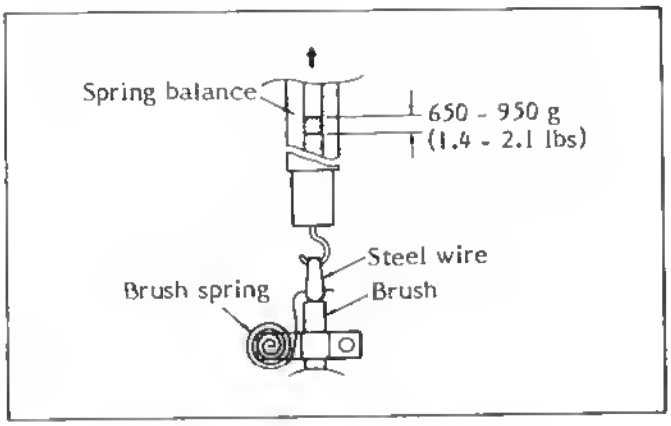
NOT CONDUCTING (R x 100)

5. INSPECTION



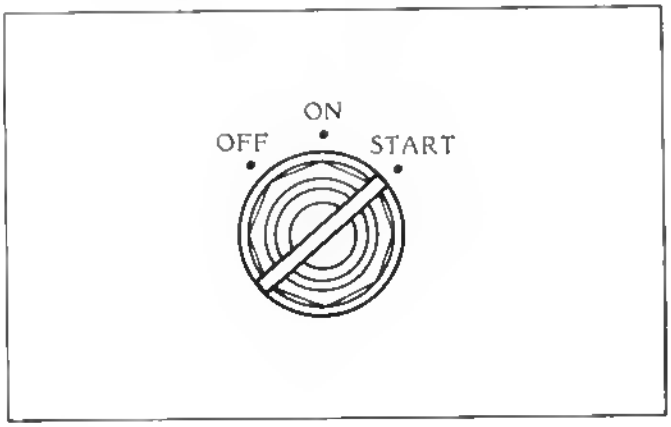
d. Check the brush length. Replace the brush if at or near its limits.

Minimum brush length:
8.5 mm (0.335 in)



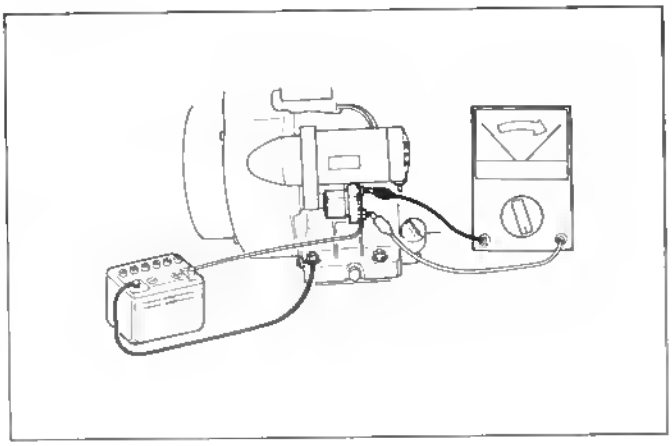
e. Check the brush spring pressure. Compare it with a new spring. Replace the old spring if it is weak.

Brush spring pressure:
650 - 950 g (1.4 - 2.1 lbs)

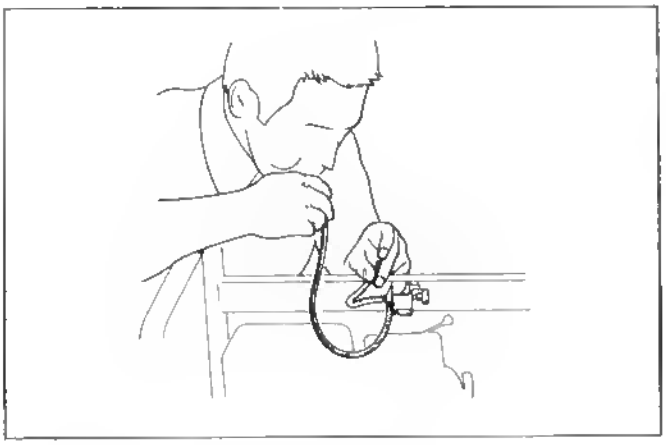


Starter relay

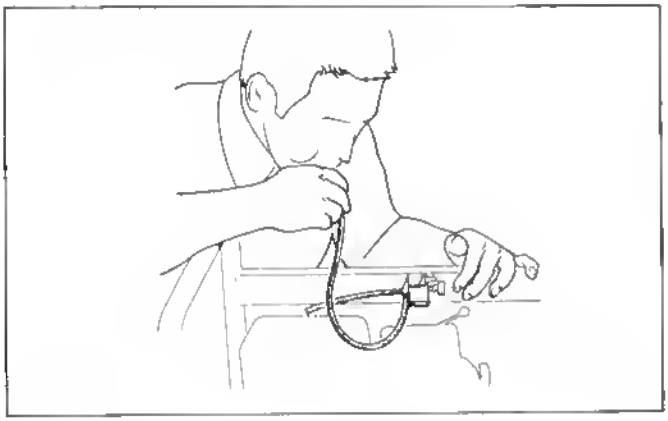
a. Disconnect the starter cable at the relay.
b. Connect the pocket tester leads to the relay terminals (R x 1).
c. Turn the ignition to the "START" position.
d. The starter relay should click once, and the scale on the tester should read zero. If it does not read zero, the relay must be replaced.

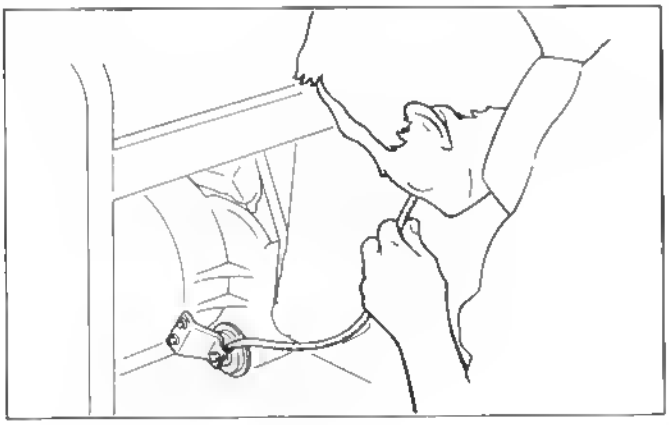


5. INSPECTION

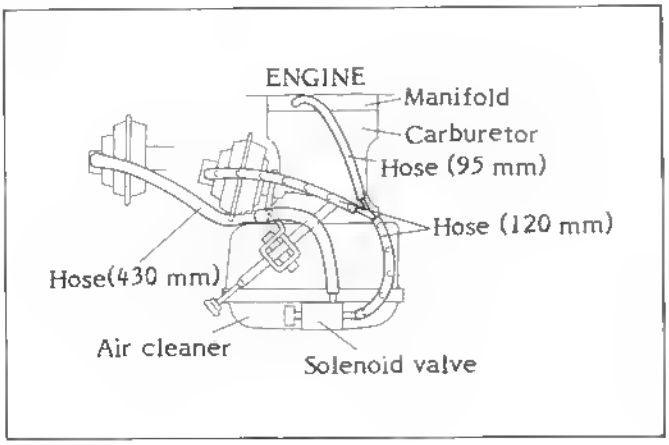


Checking for air leaks





Diaghram
Check for air leaks



For "B" model

NOTES:
1. Use care not to twist hoses when installing.
2. After installing, make sure hoses do not contact the link rod, governor, or any other parts.

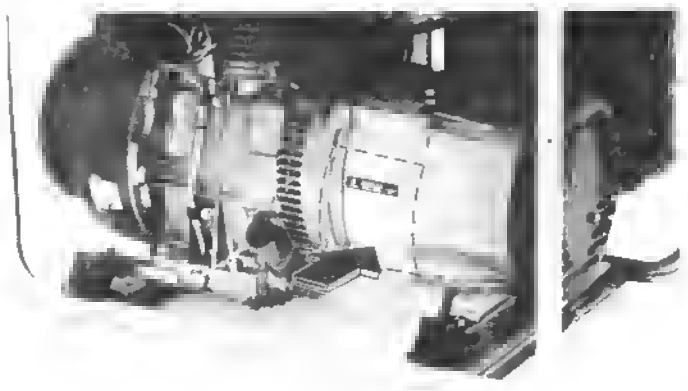
6. MISCELLANEOUS

6-1. TIGHTENING TORQUE

	Thread size	Torque		
		cm·kg	Nm	ft·lb
Cylinder head	M10 x 1.25	400 - 450	40 - 45	28.9 - 32.5
Connecting rod	M8 x 1.25	180 - 220	18 - 22	13.0 - 15.9
Spark plug	M14 x 1.25	150 - 200	15 - 20	10.8 - 14.5
Crankcase cover	M8 x 1.25	180 - 200	18 - 20	13.0 - 14.5
Flywheel magneto	M18 x 1.5	1,100 - 1,300	110 - 130	79.6 - 94.0
Breather cover	M6 x 1.0	60 - 80	6 - 8	4.3 - 5.8
Fancase	M6 x 1.0	60 - 80	6 - 8	4.3 - 5.8
Air shroud	M6 x 1.0	60 - 80	6 - 8	4.3 - 5.8
	M10 x 1.25	400 - 450	40 - 45	28.9 - 32.5
Governor arm	M6 x 1.0	60 - 80	6 - 8	4.3 - 5.8
Air cleaner	M8 x 1.25	150 - 170	15 - 17	10.8 - 12.3
Oil warning	M35 x 1.5	80 - 90	8 - 9	5.8 - 6.5
Balancer housing	M6 x 1.0	80 - 100	8 - 10	5.8 - 7.2
Drain plug	M12 x 1.25	500 - 600	50 - 60	37 - 43
Rotor ass'y	M12 x 1.25	400 - 500	40 - 50	29 - 36
Stator ass'y	M6 x 1.0	60 - 90	5.9 - 8.8	4.3 - 6.5

In case no tightening torque is specified, the following table should apply.

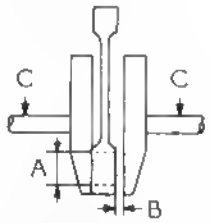
Thread size	Tightening torque		
	cm·kg	Nm	ft·lb
M4	15 - 25	1.5 - 2.5	1.1 - 1.8
M6	50 - 80	5 - 8	3.6 - 5.8
M8	120 - 190	12 - 19	8.7 - 13.7
M10	230 - 360	23 - 36	16.6 - 26.0



Generator identification
The generator set serial No. is stamped on the position shown in the photo.
The first three digits of these numbers are for model identification: the remaining digits are the unit production number.

6-2. SERVICE DATA

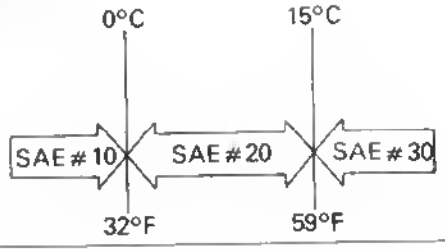
Unit: mm (in)

ITEM	G5410(B)-DG-ONAN		
	STD		Limit
Engine compression pressure	6 kg/cm^2 (85 psi)		5.5 kg/cm^2 (78 psi)
PISTON			
Piston size	86.0 (3.386)		-
Over size	86.25 (3.396)		-
	86.50 (3.406)		-
Piston clearance	0.065 - 0.075 (0.0026 - 0.0030)		0.15 (0.006)
PISTON PIN			
Piston pin dia.	20.0 (0.787)		19.95 (0.785)
PISTON RING	Top	2nd	Oil
Ring design			
Ring end gap	0.1 - 0.2 (0.0039 - 0.0079)	0.1 - 0.25 (0.0039 - 0.0098)	←
Ring end gap limit	0.5 (0.0197)	0.5 (0.0197)	←
Ring groove side clearance	0.04 - 0.08 (0.0016 - 0.0031)	0.02 - 0.06 (0.0008 - 0.0024)	←
Ring groove side clearance limit	0.15 (0.0059)	←	←
CYLINDER			
Bore dia.	86.0 (3.386)		86.15 (3.392)
CRANKSHAFT			
A-Crank pin dia.	37.0 (1.457)		
B-Clearance	0.2 - 0.8 (0.0079 - 0.0315)		
Oil clearance	0.016 - 0.034 (0.0006 - 0.0013)		
C-Run out			0.03 (0.0012)
			
CONNECTING ROD			
Big end dia.	37.0 (1.457)		
Small end dia.	20.0 (0.787)		
CAMSHAFT			
Cam height EX.IN	38.00 (1.496)		37.75 (1.486)
Journal	25.0 (0.984)		24.90 (0.980)

6. MISCELLANEOUS

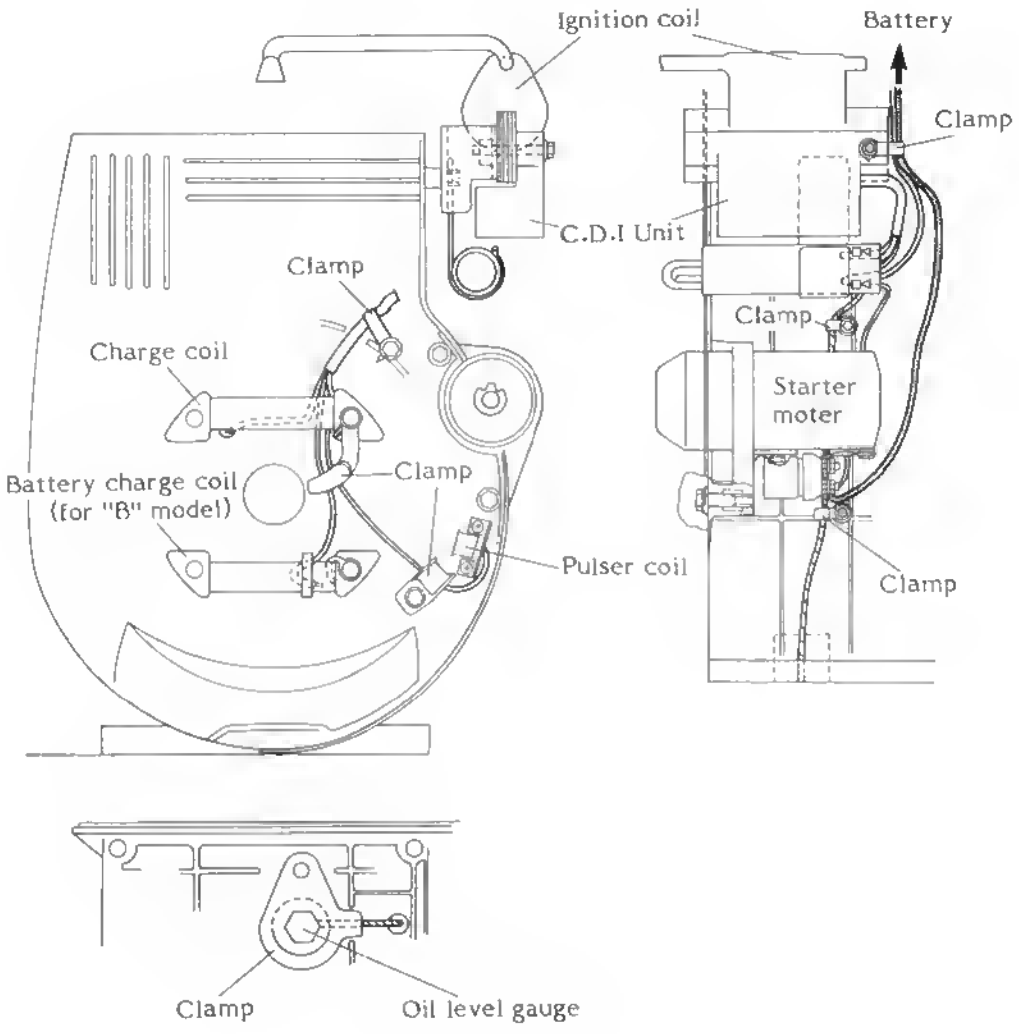
Unit: mm (in)

ITEM	GS410(B)-DG-ONAN	
	STD	Limit
VALVE		
Valve clearance (cold) IN	0.10 - 0.20 (0.0039 - 0.079)	
EX	0.20 - 0.30 (0.0079 - 0.0118)	
Valve seat width (IN, EX)	0.7 - 0.9 (0.028 - 0.035)	2.0 (0.079)
Valve stem dia. (IN, EX)	7.0 (0.276)	EX: 6.75 (0.2666), IN: 6.8 (0.268)
Valve spring free length	41 (1.614)	39 (1.535)
Valve spring tilt		2.0 (0.079)
CARBURETOR		
Type	MIKUNI BV26-21	
Bore size	26	
Setting		
Main jet (M.J.)	#112.5	
Air jet (A.J.)	1.6	
Pilot jet (P.J.)	#65	
Pilot screw (P.S.)	1-1/4 (turn out)	
Valve seat size	2.0	
Float height	13.0 ± 1.0 (0.51 ± 0.04)	
LUBRICATION		
Engine oil quantity	1,200 cm^3 (1.27 US qt, 1.05 IMP qt)	
Engine oil grade	4-stroke engine oil API Service Classification SE or SF (if not available, SD)	
ELECTRICAL		
Ignition system	C.D.I.	
Pulser coil resistance	197 Ω ± 10%	
Charge coil resistance	315 Ω ± 10%	
Battery charge coil resistance *	0.77 Ω ± 10%	
Ignition timing	B.T.D.C. 20°/3,600 rpm	
Primary coil resistance	0.76 Ω ± 10%	
Secondary coil resistance	10k Ω ± 20%	
Starter motor*		
Brush length limit	8.5 (0.335)	
Brush spring pressure	650 - 950 g (1.4 - 2.1 lbs)	
Commutator Dia.	27 (1.06)	
Mica under cut	0.4 - 0.8 (0.016 - 0.03)	



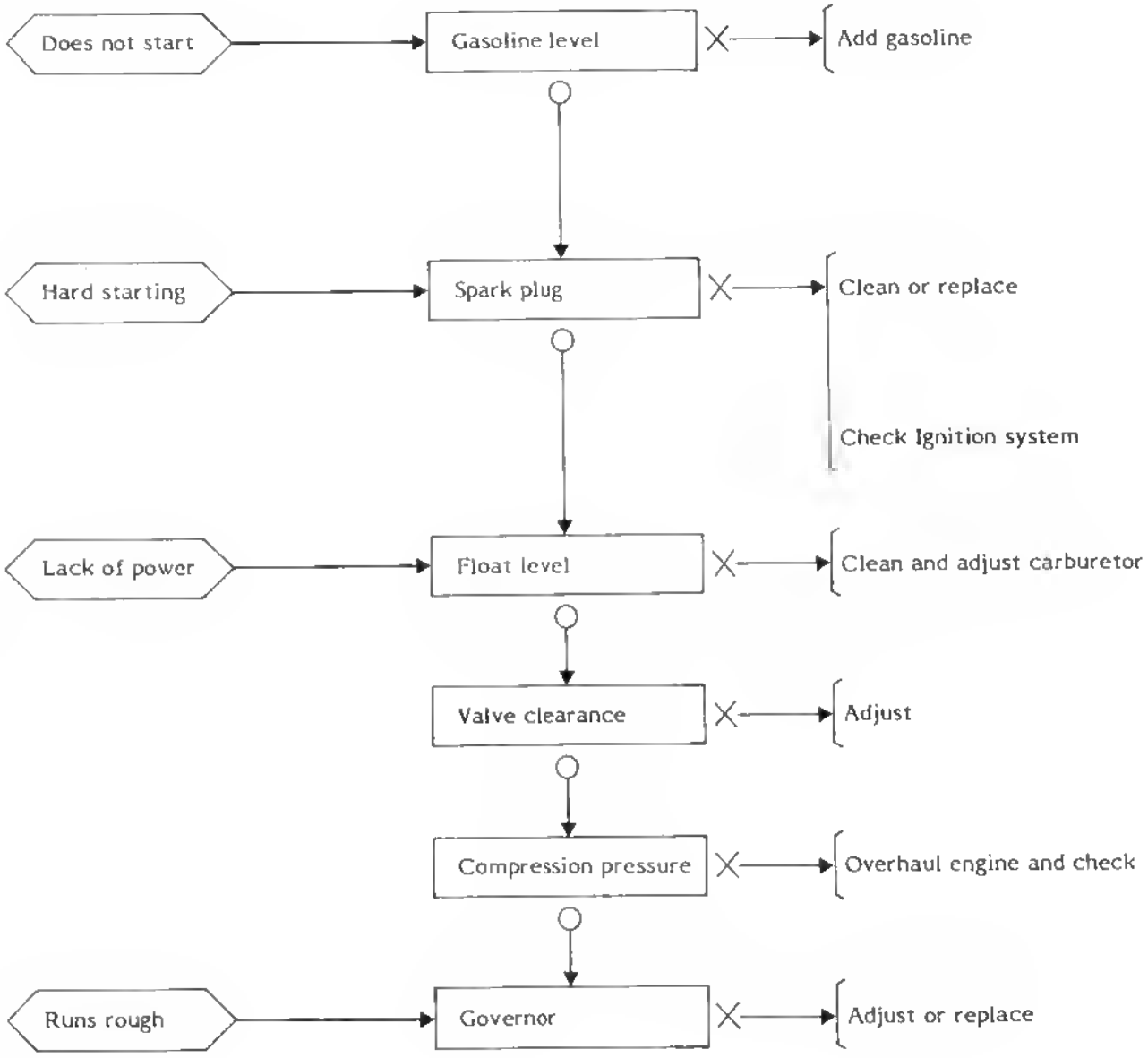
*: For electric starter model

6-3. CABLE ROUTING DIAGRAMS

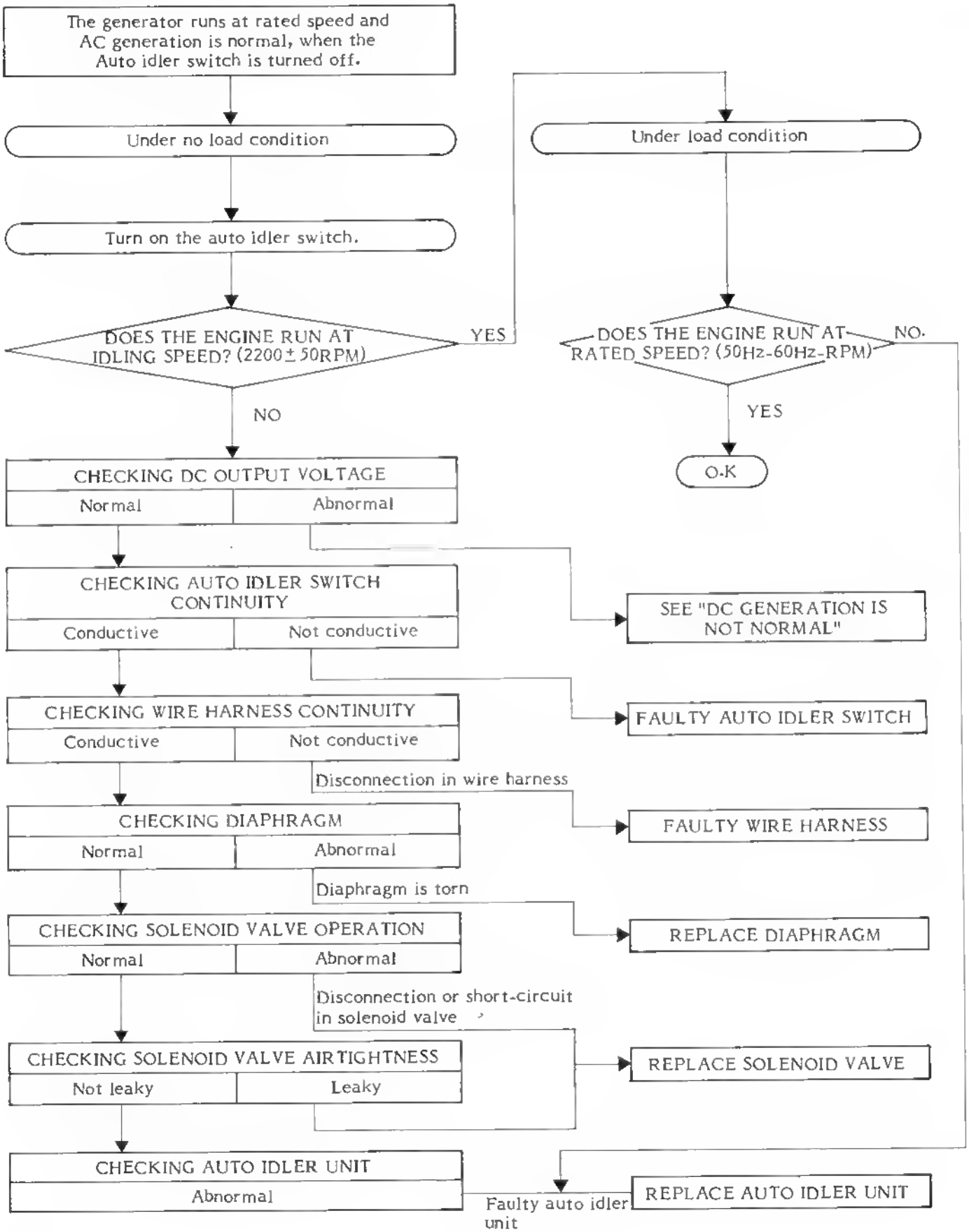


7. TROUBLESHOOTING

7-1 ENGINE



7-2. AUTO IDLER OPERATION IS NOT NORMAL



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